THE FISHES OF THE INDO-AUSTRALIAN ARCHIPELAGO

II

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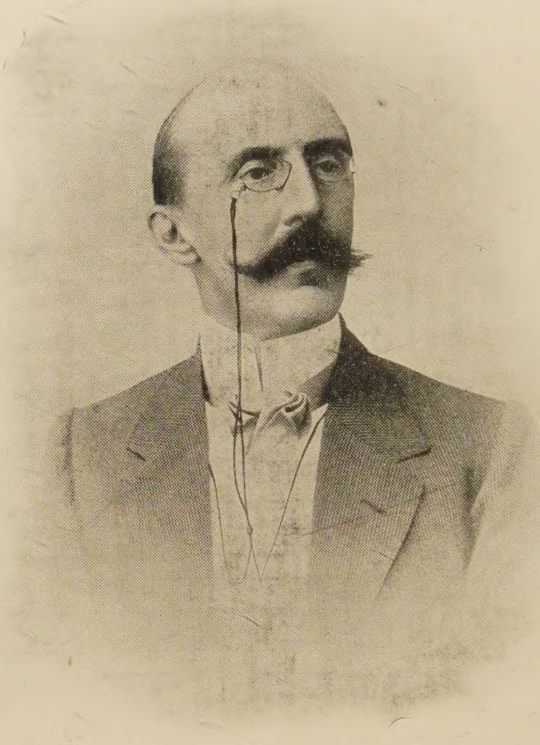

MELCHIOR TREUB.

1851—1910.

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THE FISHES

OF THE

INDO-AUSTRALIAN ARCHIPELAGO

II

MALACOPTERYGII, MYCTOPHOIDEA, OSTARIOPHYSI: I SILUROIDEA

with 151 illustrations

BY

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AND

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LEIDEN — 1913.
E. J. BRILL Ltd.

Ref. Shelf
QL 623.1
W4
V.2
c.1
316 60

Printed by E. J. Brill, Leyden (Holland).

IN MEMORY

of

Prof. Dr. MELCHIOR TREUB,

late Director of the Botanical Gardens at Buitenzorg and of the Department of Agriculture in Dutch East India.

The first volume of this work was by its contents an "in memoriam" of P. BLEEKER, who has done more than any man to promote our knowledge of the ichthyology of the Indo-Australian Archipelago.

This second volume, the first of a series which describes the fishes of that Archipelago, is dedicated to the late Prof. MELCHIOR TREUB. More than any one else he has promoted scientific life in Netherlands India and has succesfully taught, that science is the base also of practical colonial enterprise. He knew that scientific exploration of the unknown fields of a colony is a charter of their possession, and he accordingly promoted their exploration. His last official act was to procure governmental aid for this present work; may it be a slight token of our esteem for his everlasting labors.

INTRODUCTION.

The first volume of this work contains an Index of the ichthyological papers of P. BLEEKER, as these are indispensable to everyone, who studies tropical Indo-Pacific fishes.

In the following volumes the authors will endeavour to give a concise description of all the fishes at this moment known to inhabit the Indo-Australian Archipelago.

This work aims, in the first place, to be a faunistical one. Thus our first task must be, to give a definition of this region. We followed P. and F. SARASIN, MAX WEBER, P. N. VAN KAMPEN and others in calling it "*Indo-Australian* Archipelago", as this region includes the many islands between Sumatra and New Guinea and thus connects the utterly different faunas of India and Australia. The western islands of the Archipelago derive part of their fauna from India, the eastern islands from Australia. This dualism is expressed in the name Indo-Australian Archipelago. But just because of this Archipelago forming a link between two continents without strongly marked boundaries, it is necessary to call to aid artificial boundaries. Political boundaries are useless in this respect. For instance Borneo, Timor, New Guinea, each of which belongs to more than one colonial power, certainly form part of the Archipelago.

As it reaches westwards to the Asiatic Continent, we have included for our purpose the island Singapore, all the more so as this island forms a continuation of the Rio and Linga Archipelago. Eastwards our region terminates with New Guinea. This large island at the same time defines the *southern* boundary in the east, Australia being therefore excluded. This appears to us to be logical. For, although Australia has many faunistical points in common with New Guinea and the Aru Islands, and although the littoral fauna of its tropical part is closely connected with that of the Indo-Australian Archipelago, the mere fact that Australia reaches far beyond the southern tropic into the temperate zone, gives to this large part of the world its own characteristic fauna.

For the rest the southern boundary of the Archipelago is naturally determined by the chain of islands which reaches from South New Guinea in the east, to Pulu Weh, west of Sumatra.

For practical reasons we were obliged to trace an artificial *northern* boundary to our region, as we excluded the Philippines but included the Sulu Archipelago, which shows a great affinity with Borneo. Besides this small archipelago, the northern part of our region includes all the islands, which belong to the Dutch East Indies.

Zoogeographically the part of the world, now under consideration, forms therefore an Austro-Malay or Indo-Australian transition region between the Notogaea and the so-called oriental region of the Arctogaea.

This is one cause for the wealth of the fishfauna of this part of the world. The great diversity in the conditions of life is another, even greater cause for its being one of the richest tropical faunas of the world. Its area is far above five millions of square kilometers, exceeding therefore the area of Europe without Russia. It consists of numerous islands, some of which are amongst the largest of the world and equal France in extent. These contain great rivers and swamps, volcanic ranges with mountain lakes, mountains which reach above the snowline and where alpine brooks and rapid torrents are abundant. Often an extensive lowland lies between these mountains and the sea, and here the slowly flowing rivers form swamps and widely ramified estuaries, which are under the influence of the tide and contain brackish water of diverse salinity.

Other islands are mere low coral islands or reefs, which just emerge above the level of the sea and scarcely yield any freshwater fauna.

As great a diversity is found in the localities, where marine fishes can live. About three millions and a half of the above-mentioned five millions of square kilometers are covered by sea. Part of it is shallow, as the Java Sea, the bottom of which consists of terrigenous mud, sand or detritus of coral. On the other hand the Archipelago is characterized by deep basins as the Celebes- and Banda Sea, which have depths of up to 6500 M. and belong to the deepest seas of the world.

Situated between the Indic and the Pacific, these differently

formed basins and seas communicate through wide as well as through narrow straits with each other and with the oceans. But for the rest they are more or less enclosed between the numerous islands, which in the west of the Archipelago are generally bordered by a sandy beach or rocky coast, and in the east by coral reefs or often by Lithothamnion banks, covered by shallow water only.

The shallow sea with its diversity of bottom-material, the deep sea, the coral reefs, the Lithothamnion banks, the sandy and the rocky coasts, the Pelagial near the coast or far out in the sea, all represent as many different areas, which yield an equally great diversity of inhabitants, a diversity corresponding with the qualitative as well as the quantative richness of the ichthyological fauna of the Archipelago.

It is no wonder that such a wealth of fishes, in freshwater as well as in the sea, is of great importance to a population, which lives for a very large part along the coast. Among them are tribes who practise fishery with vessels, specially and ably constructed by themselves for this purpose, using often cunningly devised appliances and even apply fishnursing. Other tribes confine themselves to fishing without leaving the shore, still others are content with a primitive mode of catching fish at low tide along the beach and on the coral reefs.

The manifold native names, given to the fishes, are in accordance with the multiplicity of languages spoken in the Archipelago. Even as with us, the nomenclature has grown still richer, by the many local names which the same fish bears.

We have recorded under: "nomina indigena" those native names, which seemed to us to be trustworthy. We are of opinion that no great value ought to be attached to them, as the unavoidable series of difficulties is still enlarged by the fact, that the authorities for those names have mostly been European ichthyologists and no linguists.

Our work is a systematical one. The System of the Teleostei is in a state of development, which is far from being complete. This explains the very different conceptions since GÜNTHER wrote his Catalogue of Fishes, a work that will always remain a monument of knowlegde and industry.

The systematic arrangement, adopted by us, is in many instances a compromise between modern conceptions and those of former authors.

In the case of nomenclature we have endeavoured to follow as much as possible the international rules, without falling into excesses, and without demolishing every bridge to the known past.

It may be expected of a faunistical work, that it gives the distribution of the species as accurately and as extensively as possible. Therefore all localities in the Archipelago, where we knew a certain species to occur, were included. We followed the botanists by putting a (!) after those localities, from which we have seen specimens. When the range of a species extends outside our region, this wider distribution has also been recorded under "Habitat".

We are well aware that the last word in matters of distribution has not yet been spoken, nor do we doubt that in future still many a new species will have to be added to the Indo-Australian fauna. This being still possible in a fishfauna from as small a sea as the North Sea, which has been studied so much and is situated within reach of ichthyologists of different civilised nations, how much greater is the chance in a far off region such as ours, which is so much larger and of such a diversity of conditions of life. It is clear that only a part of its fauna — though it be by far the most important one — can be known.

Although this is a weak point in a faunistical work like ours, it would be useless to defer publishing it till the fauna is better known. This would be a removal ad calendas graecas. Besides, a work such as this, can be a help to increase the knowledge of the fauna and to stimulate further research.

Even after the extensive work of P. BLEEKER, to which we have so to say erected a monument in our first volume, a work on the fishes of the Indo-Australian Archipelago is still wanted. BLEEKER's Atlas ichthyologique remained incomplete. His other writings can only partially supply the missing parts.

Moreover, since BLEEKER's death in 1878 our knowledge has greatly increased, many new species having been described. The deep-sea fauna was totally unknown to him, as well as the freshwater fauna of New Guinea und the neighbouring islands of Waigeu, Aru and Kei. Expeditions to unknown parts of Borneo, Sumatra, Celebes, to the Lesser Sunda Islands, Ceram, etc. in the last 20 years, have added much to our knowledge of the fishfauna.

Personally we had a large material at our disposal. The collection of the Museum at Amsterdam has been greatly increased of late years by material from the Indo-Australian Archipelago, partly collected by us. Part of it has already been described by us.

Among the collections, which have not yet been described we mention the following:

From *Nias*, made by Dr. J. P. KLEIWEG DE ZWAAN;

from *Borneo*, made by Dr. H. A. LORENTZ, Dr. L. RUTTEN and Mr. W. J. TISSOT VAN PATOT;

from *Sumatra*, made by Dr. L. P. DE BUSSY, F. K. Baron VAN DEDEM, Dr. A. J. SALM, Mr. V. D. WERFF and Mr. E. C. A. HERBST, but above all by Mr. and Mrs. MOOLENBURGH, to whom we are indebted for a very rich collection;

from *Simalur*, made by Mr. E. JACOBSON, who made extensive collections in this island, the fishfauna of which was quite unknown;

from *Central* and *Southeast Celebes* by Mr. E. C. ABENDANON;

from the *Java Sea* and the *Lesser Sunda Islands* collections of marine and freshwater fishes made by Mr. P. BUITENDIJK, the late Dr. G. A. J. VAN DER SANDE, by Dr. H. F. MINKEMA and Colonel G. F. TYDEMAN;

from *New Guinea* and the *Aru Islands* made by Mr. N. G. B. HENDRIX;

from *Buton Island* made by Dr. P. TH. JUSTESEN.

We are glad of this opportunity to thank the above-named collectors, but also Dr. J. C. KONINGSBERGER, and Dr. P. N. VAN KAMPEN, who enabled us to examine part of the material, collected during the cruises of the Research-steamer "Gier".

In other respects too we had the advantage of having the collaboration of Dr. J. C. KONINGSBERGER, director of "'s Lands Plantentuin" at Buitenzorg.

We gladly repeat our thanks, which we had already the pleasure to express in the introduction to the first volume.

We are glad to add our thanks to Major OUWENS, keeper of the Zoological Museum at Buitenzorg.

Finally we must say a few words about the arrangement of our descriptions of the species and about the synonymy.

With exception of a few species, which we had no opportunity to study, our descriptions are based, if possible, on more than one specimen of a species. We had the opportunity

to examine some typical species in the Leyden Museum and in the British Museum and beg to express our thanks to Miss C. POPTA and Mr. C. TATE REGAN. We are also indebted to Dr. PELLEGRIN, who had the kindness to inform us about a few types in the Muséum d'histoire naturelle at Paris.

In describing the fishes we understand by *Length* in the discussions of the proportions, the distance between the snout and the base of the caudal fin; in giving the largest size known for a species, we include the caudal fin.

The *Head* is measured from the tip of the snout to the end of the opercle, its proportion to the length is indicated *e.g.* as follows: head 4—$4^1/_2$ means, that the length of the head is contained 4 to $4^1/_2$ times in the length.

Height is the maximum height; in special cases it is indicated how it is measured; the figures placed behind "height" indicate how many times it is contained in the length.

The size of the *Eye*, the length of the *Snout*, of the *Jaws* etc. are compared with the length of the head; thus "eye 4" means, that its diameter is $^1/_4$ of the length of the head.

In counting the *Scales*, under "*L. l.*" is given the number of scales, with or without sensory organs, between the head and the caudal fin or, in most cases, between that fin and the upper corner of the opercle.

L. t. $\frac{3^1/_2}{6\,(7)}$ signifies, that there are $3^1/_2$ rows of scales between the dorsal and the lateral line and 6 to 7 below it, the lateral line itself not counted. There are cases, in which *L. t.* means the transverse series of scales in the maximum height of the fish; when applying other methods, this is indicated in the description of the species.

In the *Fin formulae* the spines and the simple, non-branched rays are generally indicated by a figure, separated by a point from that of the number of the branched rays.

The last soft ray of the dorsal, in case it is cleft to the base and therefore counted as two by some authors (BLEEKER *e.g.*), is reckoned as one, being supported by a single pterygophore.

The *Gillmembranes* may be totally free from each other and from the isthmus; they may be united, but still remain free from the isthmus; or they may be connected with the isthmus and with each other. When in the last case the posterior border of the united gillmembranes is not quite adnate to

the isthmus, there remains a free posterior margin, running as a fold over the isthmus from one gillopening to the other.

The number of the *Gillrakers* as given by us, are those counted on the lower branch of the first gillarch; the most inferior are neglected if they are quite rudimentary.

As already told, we follow the law of priority and use the oldest name which can with certainty be made out by the description belonging to a certain species. Its author is cited as the author of the species and his paper is quoted in the first place.

Mention is further made of all synonyms; besides, we have quoted those papers, which contain a description of the species. If it is a widely spread one, only those papers are quoted, which contain a description of or give some informations — others than those regarding locality only — about Indo-Australian specimens of that species.

According to the international rules of nomenclature we have neglected the generic names, as *e.g.* those of SWAINSON, which are not accompanied by a description.

Finally there remains for us the pleasing duty of expressing our sincere thanks to Mrs. C. J. DE BEAUFORT for her kind and valuable help in reading the proofs.

Our thanks are also due to Prof. A. E. H. SWAEN of the University of Amsterdam for his linguistic advice so cordially given.

Our recognition of indebtness must also include Mr. J. F. OBBES, whose ability as a zoological artist has enabled us to give a figure of at least each genus.

MAX WEBER.
L. F. DE BEAUFORT.

Eerbeek, Holland, November 1913.

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TELEOSTEI

Order MALACOPTERYGII Cuvier.

(*Isospondyli* Cope, *Clupeiformes* Goodrich)

Physostome. Generally scaly; lateral line present or absent. Skull with a supraoccipital, separated from the frontals by the parietals. Maxillary entering the gape to a greater or less extent. Opercle well developed, its bones complete. Anterior vertebrae not co-ossified, forming no Weberian ossicles. Pectoral arch suspended from the skull, mesocoracoid present. Fins without true spines; ventrals, if present, abdominal.

Artificial key to the families.

I. Lateral line present.

A. Gular plate (Fig. 1) between branches of lower jaw *Elopsidae* p. 2.

B. No gular plate.

1. Head scaled. Belly with double serrature . . . . *Notopteridae* p. 8.

2. Head naked. No abdominal serrature.

a. Teeth present.

aa. Anal far behind dorsal. Scales small . . . *Albulidae* p. 6.

bb. Anal opposite to dorsal.

α. Scales large; lower jaw with a pair of barbels; freshwater . . . . . *Osteoglossidae* p. 12.

β. Scales moderate or wanting; no barbels; deep sea. . . . . *Alepocephalidae* p. 98.

b. No teeth.

Anal far behind dorsal . . . . . *Chanidae* p. 14.

II. No lateral line.

A. No adipose fin. No photophores. Parietals present. Pectorals always developed, ventrals sometimes rudimentary or wanting. Airbladder contiguous with auditory organ. . . . . *Clupeidae* p. 16.

B. Adipose fin present or absent. Photophores present. Parietals absent. Pectorals sometimes rudimentary or wanting; even in last case ventrals may be well developed while otherwise they may be absent . . *Stomiatidae* p. 105.

1. Fam. Elopsidae.

Oblong or elongate, more or less compressed. Scales cycloid, silvery. Head naked, with an occipital collar of thin, large scales. Mouth large, terminal; lower jaw prominent. Intermaxillaries short, not protractile. Lateral border of mouth formed by maxillaries, which have two supplemental bones. An elongate bony gular plate between branches of mandibula (Fig. 1). Villiform teeth on jaws, vomer, palatines, pterygoids and tongue. A straight lateral line with simple or radiating tubes. An axillary scale above pectorals and ventrals. Dorsal slightly behind origin of ventrals. Pectorals low down, folding like ventrals. Anal far behind dorsal. Gillrakers 13—30. Gillmembranes separated, free. Branchiostegals numerous. Pseudobranchiae present or absent.

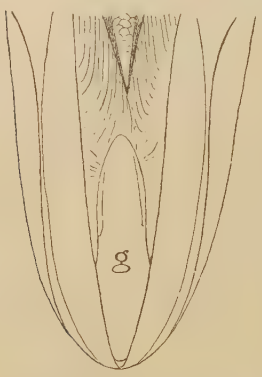

Fig. 1.
Underside of head of *Elops hawaiensis* Regan.
g gular plate.

Synopsis of the genera.

a. Large pseudobranchiae. Dorsal and anal depressible in a scaly sheet. Dorsal fin without produced rays, longer than anal. Scales small . . . . . *Elops* p. 2.

b. No pseudobranchiae. Dorsal and anal without a scaly sheet. Dorsal fin with last ray produced, shorter than anal. Scales large . . . . . *Megalops* p. 4.

1. Elops Linné.

(Linné. Syst. nat. ed. XII[a], I. 1766, p. 518).

Elongate. Scales thin, small, forming sheets for the depressible anal and dorsal; those along the straight lateral line with a simple tube; a scaly occipital collar. Pectorals and ventrals with an accessory scale. Mouth bordered above by well developed intermaxillaries and very long maxillaries, which have two supplemental bones. Dorsal slightly behind origin of ventrals, none of its rays prolonged, longer than anal. Pectorals and ventrals moderate. Fine teeth on jaws, vomer, palatines, pterygoids and tongue. Pseudobranchiae large. Branchiostegals

numerous. When young ribbon-shaped, passing through a series of stages like those seen in *Albula*.

Synopsis of the species.

A. Lower jaw included, the whole of the intermaxillary band of teeth exposed when the mouth is closed. Head $3^3/_5$—4 . . . . . *E. hawaiensis* p. 3.

B. Lower jaw projecting, covering the anterior part of the intermaxillary band of teeth when the mouth is closed. Head $4^1/_3$—$4^2/_5$, ... *E. machnata* p. 4.

1. Elops hawaiensis T. Regan.

Elops saurus Bleeker. Atl. Ichth. VI. 1866—1872, p. 84 (not of Linné).
Elops hawaiensis Regan. Ann. Mag. Nat. Hist. ser. 8. III. 1909, p. 39.
Elops hawaiensis Günther. Fische der Südsee. Heft VIII. 1909, p. 386.
Elops hawaiiensis Jordan & Richardson. Mem. Carnegie Mus. Vol. IV. n°. 4, 1909, p. 165.
Elops hawaiensis Max Weber. Siboga-Exp. Fische. 1913. p. 1.

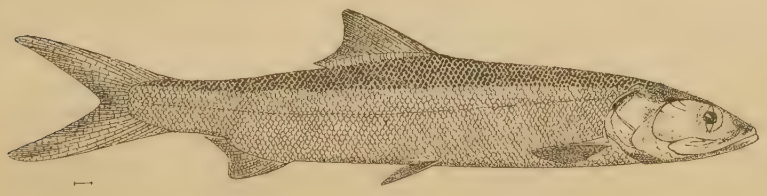

Fig. 2. *Elops hawaiensis* Reg.

B. 27—31; D. 24; A. 15—16; P. 17—18; V. 14—15; L. l. 96—98.

Height $5^1/_2$, head $3^3/_5$—4, eye 4—5. Snout nearly as long as or a little longer than eye. Maxillary extending far beyond eye. Lower jaw included, the whole of the intermaxillary band of teeth exposed when the mouth is closed. Origin of dorsal much nearer to caudal than to snout. Height of dorsal about equal to its length and equal to head without snout. Anal far behind dorsal. Ventrals a little nearer to base of caudal than to tip of snout, longer than half of head, about as long as pectorals, which are a little less than half their distance from the ventrals. Their origin before origin of dorsal. Fine teeth on jaws, vomer, palatines, pterygoids and tongue. Thirteen to 14 strong flattened gillrakers, with conspicuous

spines on the innerside, a little longer than branchial filaments, equalling about $^3/_4$ of eye. Scales with the hindborder irregulary crenulated and indentated. Colour silvery. Length 450 mm.

Nomen indig. Bandang lalaki (Mal.).

Habitat: Java (Batavia!, Surabaya, Pasuruan); Madura; Pinang; Singapore; Celebes (Macassar!, Badjoa, Pompanua). — Formosa; Hawaii.

In sea.

2. Elops machnata (Forsk.).

Argentina machnata Forskål. Descript. Animal. 1775, p. 68.
Elops saurus Bleeker. Atl. Ichth. VI. 1866—1872, p. 84. (not of Linné). (pro parte?).
Elops machnata Regan. Ann. Mag Nat. Hist. ser. 8. III. 1909, p. 39.
Elops machnata Bean & Weed. Proc. U. S. Nat. Mus. XLII. 1912, p. 589.

B. 28—32; D. 21—23; A. 15—16; P. and V.?; L.l. 94—98; L. tr.?

Height $5—5^2/_3$, head $4^1/_3—4^2/_5$, eye $4^1/_2—4^2/_3$. Snout as long as or longer than the eye. Maxillary extending beyond the eye. Lower jaw projecting, covering the anterior part of the intermaxillary band of teeth when the mouth is closed. Pectorals $^3/_5$ length of head, extending a little less than $^1/_2$ of the distance from their base to the ventrals. Origin of ventrals a little nearer to base of caudal than to the end of snout. Fourteen gillrakers. Silvery. Length 680 mm. [Not seen by us].

Habitat: Java (Batavia). — Cape of Good Hope; Red Sea; Madras; China and Japan.

The indo-australian *Elops* has been considered by previous authors to belong to the circumtropical *Elops sanrus* L. This species has recently been split by REGAN in several ones. The numerous specimens seen by us, amongst which several of BLEEKER's collection, all belong to *Elops hawaiensis*. On account of its distribution it was to be expected that *Elops machnata* also occurs in the Archipelago, which was recently confirmed by BEAN & WEED.

In sea.

2. Megalops Lacépède.

(LACÉPÈDE. Hist. Nat. d. Poissons, V. 1803, p. 289).

Oblong, slightly compressed. Scales thin, large, those of the lateral line with radiating tubes. An axillary scale above pectorals and ventrals. Mouth oblique, bordered above by a conspicuous praemaxillary and a large rounded maxillary with

two supplemental bones. Mandibula prominent. Eyes large. Dorsal behind origin of ventrals, shorter than anal. Last

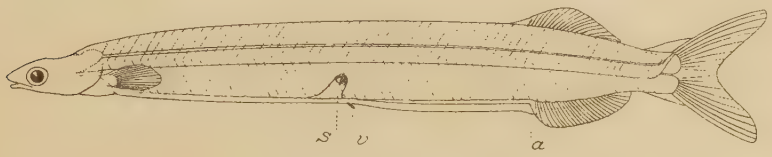

Fig. 3. Larval stage of *Megalops cyprinoides* Brouss. × 4; after VAN KAMPEN. *a* anus, *s* swimbladder, *v* ventral fin.

dorsal ray produced in a long filament. Villiform teeth on jaws, vomer, palatines, pterygoids and tongue. Branchiostegals 23—27. No pseudobranchiae.

Passing through a ribbon-shaped larval stage. (Fig. 3).

1. Megalops cyprinoides (Brouss.).

Clupea cyprinoides Broussonet. Ichthyol. Dec. I. 1782.
Megalops indicus Bleeker. Journ. Ind. Arch. III. 1849, p. 67.
Elops cundinga Cantor. Journ. Asiat. Soc. Bengal. XVIII. 1850, p. 1271.
Megalops macropthalmus Bleeker. Nat. Tijdschr. Ned. Ind. I. 1851, p. 421.
Megalops indicus Kner. Fische Novara Exp. 1865—67, p. 339.
Megalops cyprinoides Günther. Cat. Brit. Mus. VII. 1868, p. 471.
Megalops macropterus Bleeker. Atl. Ichth. VI. 1866—72, p. 85.
Megalops filamentosus Bleeker. Atl. Ichth. VI. 1866—72, p. 86.
Megalops kundinga Bleeker. Atl. Ichth. VI. 1866—72, p. 87.
Megalops cyprinoides Bleeker. Atl. Ichth. VI. 1866—72, p. 87.
Megalops cyprinoides Day. Fishes of India. 4°. 1878—88, p. 650.
Megalops cyprinoides Sauvage. Hist. Madagascar. Vol. XVI. 1891, p. 495.
Megalops cyprinoides Günther. Fische der Südsee. Heft VIII. 1909, p. 387.
Megalops cyprinoides Max Weber. Siboga-Exp. Fische. 1913. p. 1.

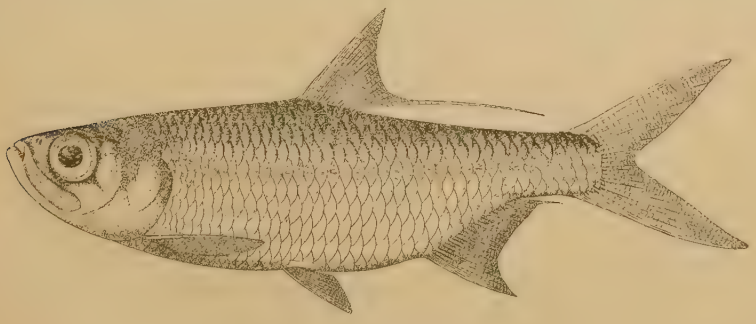

Fig. 4. *Megalops cyprinoides* Brouss.

B. 23—27; D. 16—20; A. 23—28; P. 14—15; V. 10—11; L. l. about 40; L. tr. 12.

Oblong, slightly compressed, ventral profile more convex than dorsal, belly rounded. Height $3^1/_2$—5, head $3^1/_2$—4, eye $2^3/_5$—$3^1/_2$, longer than snout. Lower jaw prominent. Maxillary reaches to a little before or somewhat behind hindborder of eye. Origin of dorsal midway between snout and base of caudal, or a little nearer to caudal, nearly twice as high as long; its upperborder concave and its last ray produced into a filament. Anal concave, much longer than dorsal. Ventrals below dorsal, their origin before that of dorsal and midway between anal and origin of pectorals. Villiform teeth on jaws, vomer, palatines, pterygoids and tongue. About 30 flattened gillrakers with the innerside spinulous, a third longer than branchial filaments, about $^3/_5$ of eye. Scales thin. Darkish blue, silvery below. Dorsal, caudal and upperpart of pectorals black, rest of fins hyaline. Length 555 mm.

Nom. indig.: Bulan-bulan (Mal.); Bandeng laut (Banjermassin); Bale hèbo (Macassar). Juvenes: Tjupang (Krawang).

Habitat: Java (Batavia!, Perbana, Tjiringin, Samarang, Surabaya, Pasuruan, river Panimbang (K. v. H.), Tambak Sumur!); Sumatra (Telokbetong); Singapore; Pinang; Bintang (Rio); Borneo (Balikpapan); Celebes (Makassar!, Badjoa, Pompanua, Klabat-diatas); Madura; Bali; Timor (Dehli); Ceram!; Ambon; Aru Isles; New Guinea (Merauke!, Goldie river); Schouten Islands (Mysore). — Eastward to the Society islands; Australia; Philippines; China; Riu-Kiu-islands; westward to east coast of Africa and Madagascar.

In seas and estuaries, entering freshwater. Kept in freshwater ponds in the interior of Java, the fray being obtained from the coast.

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2. Fam. Albulidae.

Elongate, slightly compressed; belly flattish. Scales cycloid, silvery, those of the single lateral line with a simple tube. Head naked, with an occipital collar of a few large scales. A large axillary scale above and a small one below pectorals and ventrals. Eye large, covered with an annular adipose eyelid. Conical snout prominent, mouth horizontal, bordered above for the greater part by the intermaxillary, only its hindpart by the edentulous maxillary, which has only one supple-

mental bone. Villiform teeth on intermaxillary, mandibulary, vomer, and palatines. Patches of coarse blunt teeth on pterygoids and tongue. Dorsal in front of ventrals. Anal very small, near caudal and far behind anus. Caudal deeply forked. Pectorals low down. Gillrakers short, tubercle-like. Gillmembranes separate, free from isthmus. Branchiostegals 14—16. Pseudobranchiae present.

1. **Albula** Bloch, Schneider.

(Bloch, Schneider, Syst. ichth. 1801, p. 432).

For characters of the single genus see those of the family.

1. **Albula vulpes** (L.).

Esox vulpes Linné. Syst. Nat. ed. X^a. 1758, p. 313.
Albula conorhynchus Günther. Cat. Brit. Mus. VII. 1868, p. 468.
Conorhynchus glossodon Bleeker, Atl. Ichth. VI. 1866—1872, p. 83.
Albula conorhynchus Day. Fishes of India. 4°. 1878—1888, p. 648.
Albula glossodon Günther. Fische der Südsee. Heft VIII. 1909, p. 385.

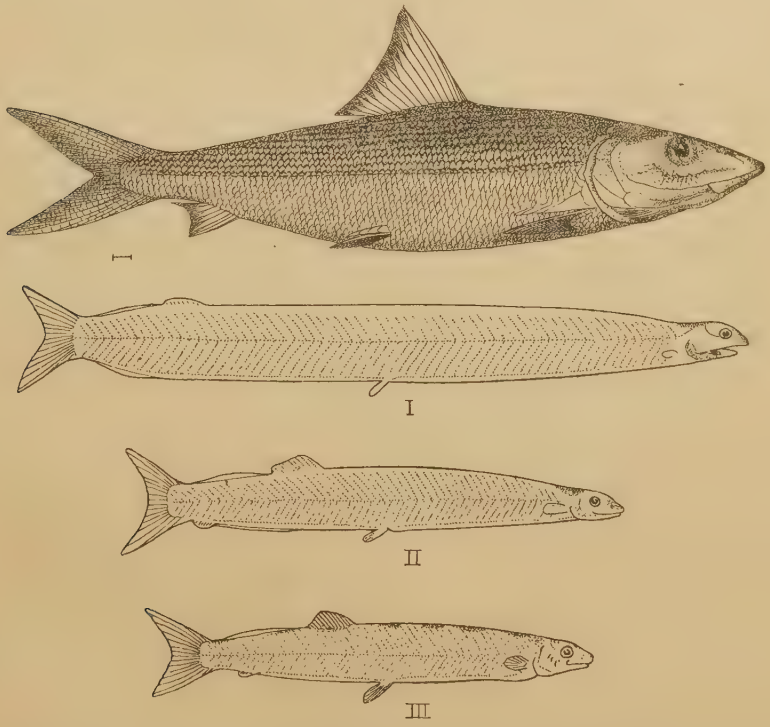

Fig. 5. *Albula vulpes* (L.) — Transformation of the translucent larvae I and II into the young fish III during which the size decreases (after Gilbert).

B. 14—16; D. 18—19; A. 9; P. 16—18; V. 9—11; L.l. 70—80; L. tr. 15 (between D. and V.).

Height $4^1/_4$, head $3^1/_2$. Dorsal much nearer to caudal than to end of snout. Origin of ventrals below last rays of dorsal. Silvery, olivaceous above, with faint dark streaks along the rows of scales. Black spot on tip of snout and nasal opening. Fins hyaline. Upper border of dorsal and caudal dusky. Young ones passing through leptocephaloid metamorphosis. Length over 900 mm.

Nom. indig.: Bandang tjurorot (Mal. Batavia).

Habitat: Java (Batavia!, Samarang, Rembang, Surabaya); Madura; Bali; Sumatra (Trussan); Pinang; Banka; Biliton; Celebes (Macassar); Obi-major; Ambon; Saparua; Ceram; New Guinea. — Circumtropical.

In sea and estuaries.

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3. Fam. Notopteridae.

Oblong, dorsal profile very convex. Very compressed. Belly with a double serrated ridge. Tail very elongate. Scales minute, cycloid; a lateral line present. Head scaled. Anterior nasal openings tubular. No suboperculum, operculum small, with a large posterior membranaceous flap; interoperculum hidden below praeoperculum, which is more or less serrated. Gape rather wide, bordered mesially by the intermaxillaries, laterally by the maxillaries. Maxillary reaching below or behind eye. Teeth on jaws, vomer, palatines, pterygoids and tongue. Short dorsal opposite to about the middle of the very long anal, which is confluent with the caudal. Ventrals united at their base, rudimentary. Gillmembranes united at their base, free from isthmus. Branchiostegals 7—9. No pseudobranchiae. Gillrakers few in number, stout; a series of blunt protuberances at the innerside of the first branchial arch.

1. **Notopterus** Lacépède.

(Lacépède Hist. Nat. d. Poissons. II. 1800, p. 189).

For characters of the single Indo-australian genus see those of the family.

Synopsis of the species.

A. Scales on opercles much larger than those of the body, 8—10 transversal rows of scales on praeoperculum. Twenty eight to 33 pairs of spines along the abdomen. Maxillary reaching to hindborder of pupil or of eye . . . . . *N. notopterus* p. 9.

B. Scales on opercles not larger than those of the body. Twelve to 22 transversal rows of scales on praeoperculum. Thirty seven to 45 pairs of spines along the abdomen.

1. Maxillary reaching far behind eye, 20—22 transversal rows of scales on praeoperculum . . . . *N. chitala* p. 10.
2. Maxillary reaching to hindborder of eye or a little beyond. Twelve to 16 transversal rows of scales on praeoperculum . . . . . *N. borneensis* p. 11.

1. Notopterus notopterus (Pall.).

Gymnotus notopterus Pallas. Spicil. Zool. VII. p. 40.
Notopterus kapirat Lacépède. Hist. Nat. Poissons. II. 1800, p. 190.
Notopterus kapirat Günther. Cat. Brit. Mus. VII. 1868, p. 480.
Notopterus kapirat Bleeker. Atl. Ichth. VI. 1866—72, p. 146.
Notopterus kapirat Day. Fishes of India. 4°. 1878—1888, p. 653.

B. 8; D. 8—9; A. 100—110; P. 15—17; V. 5; L.tr. 65. (in a vertical line through origin of anal).

Oblong, compressed. Dorsal profile behind vertex convex, from vertex to snout sloping down in a nearly straight line. Height $3^3/_4$—$3^4/_5$, head (without opercular flap) 5—$5^2/_3$. Eye $4^1/_4$—5, equal to snout or slightly longer. Maxillary reaching to hindborder of pupil or of eye; according to age, $2^1/_4$—$2^1/_2$ in length of head. The two ventral ridges of the mandible and of the praeoperculum are serrated, as well as the lower border of the suborbital bones. Origin of dorsal about midway between snout and end of caudal. Dorsal as high as postorbital part of head. Pectorals as long as head without snout. Scales on opercles much larger than those on body; 8—10 transversal rows on praeoperculum. A double series of 28—33 spines along the abdomen. Eight gillrakers, $^3/_4$ of eye, $^1/_3$ shorter than branchial filaments. A series of 8 blunt protuberances at the innerside of the first branchial arch. More or less grayish silvery, back darker. Anal and caudal often margined with blackish. Length 350 mm.

Habitat: Java (Batavia!, Samarang); Sumatra (Palembang, Laut Tador, Indragiri, Upper Langkat, river Selapian). — Siam, Burmah and British India. [1])

In freshwater.

2. Notopterus chitala (H. B.).

Mystus chitala Hamilton Buchanan. Fishes Ganges. 1822, p. 236.
Notopterus lopis Bleeker. Nat. en Geneesk. Arch. Ned. Ind. II. 1845, p. 510.
Notopterus hypselonotus Bleeker. Verh. Bat. Gen. XXIV. 1852. Bijdr. kennis Chirocentr. etc. p. 27.
Notopterus chitala Günther. Cat. Brit. Mus. VII. 1868, p. 479.
Notopterus chitala Bleeker. Atl. Ichth. VI. 1866—1872, p. 147.
Notopterus chitala Day. Fishes of India. 4°. 1878—1888, p. 654.
Notopterus chitala Popta. Notes Leyden Mus. 1906, p. 209.

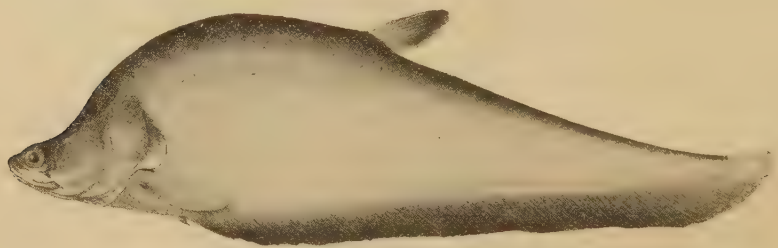

Fig. 6. *Notopterus chitala* (H. B.)

B. 8—9; D. 9—10; A. 110—135; P. 15—16; V. 6; L. l. about 200; L. tr. about 75 (in a vertical line through origin of anal).

Oblong, very compressed. Tail elongate and tapering. Dorsal profile before dorsal very convex, sloping steeply to head, the posterior profile of which is concave. Abdominal profile straight. Height $3^3/_4$—$4^1/_2$, head about 4—5 in total length; eye $4^1/_2$—$7^1/_2$, longer than snout. Maxillary reaching far behind eye, about $2^1/_2$ in length of head without opercular flap. Origin of dorsal about equidistant between caudal and end of snout or eye. Ventrals immediately before anus, united at their base, about as long as $^1/_2$ diameter of eye. Pectorals rounded, $1^1/_2$—2 times in length of head (without opercular flap). Scales

1) The occurrence in Celebes of this species as quoted by Bleeker after S. Müller is certainly erroneous (see Max Weber Siboga-Exped. Fische 1913, p. 611).

on head and body of equal size. Twenty to 22 transversal rows on praeoperculum. A double series of 37—45 spines along the abdomen. First branchial arch with 11 stout gillrakers, spinous at the innerside, longer than branchial filaments, about $^3/_4$ of eye, and below these a series of ten blunt short protuberances at the innerside. More or less silvery, back dark; when young sometimes with more than 20 oblique double silvery transverse stripes. Pectorals and ventrals hyaline, dorsal, anal and caudal dark. Axil of pectorals black. Rarely dark spots or a series of 4 or 5 black patches in the caudal region. Length 875 mm.

Nom. indig.: Lopis, Kapirat (Mal.).

Habitat: Java (Batavia, Samarang); Sumatra (Palembang, Gunung Sahilan!, Djambi!, Deli); Nias!; Borneo (Banjermassin, Pengaron Sintang, Djonkong!, rivers Mahakam and Kapuas). — Siam; Burmah; Lower Bengal to Sind.

In freshwater.

3. Notopterus borneensis Blkr.

Notopterus borneënsis Bleeker. Nat. Tijdschr. Ned. Indië. II. 1851, p. 437.
Notopterus maculosus Bleeker. Nat. Tijdschr. Ned. Indië, II. 1851, p. 438.
Notopterus borneënsis Bleeker. Atl. Ichth. VI. 1866—1872, p. 147.
Notopterus borneensis Günther. Cat. Brit. Mus. VII. 1868, p. 479.
Notopterus borneensis Volz. Zool. Jahrb. Abt. Syst. XIX. 1903, p. 410.
Notopterus borneensis Fowler. Proc. Acad. Nat. Sc. Philad. (2). LVIII. 1905, p. 489.

B. 8; D. 9—10; A. 112—124; P. 16—17; V. 4—5; L. tr. about 75 (in a vertical line through origin of anal).

Oblong, compressed. Dorsal profile convex between vertex and dorsal. Upper profile of head concave. Height $3^2/_3$—4, head $4^3/_4$—5, eye $4^3/_4$—5, longer than snout. Maxillary reaching to hindborder of eye or a little farther, $2^1/_4$—$2^1/_2$ in length of head. Lower border of suborbital bone, lower border and ridge on praeoperculum slightly serrated. Origin of dorsal about midway between snout and base of caudal in young specimens, in adults midway between eye and base of caudal. Pectorals as long as or shorter than postorbital part of head. Scales on opercles not larger than those on body, 12—16 transversal rows on praeoperculum. A double series of 37—41 spines along the abdomen. Gillrakers unknown. Grayish silvery,

back darker. Anal and caudal margined with brown. Axil of pectorals sometimes brown. Sides of body, anal and caudal sometimes with smaller or larger brownish spots. Length 430 mm. [Not seen by us].

Habitat: Sumatra (Palembang, Benakat); Borneo (Sambas, Pontianak, Kahayan, Baram).

In freshwater.

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4. Fam. Osteoglossidae.

Elongate, ventrally compressed. Scales large or very large, cycloid, composed of pieces as mosaic, those of the lateral line with a single tube. Head scaleless. Mouth bordered by the intermaxillaries and the longer maxillaries. Suboperculum much reduced, more or less concealed under praeoperculum. Teeth differing in genera. Dorsal opposite to anal, both approximated to the rounded caudal. Pectorals low down, folding against the belly. Ventrals with 5 or 6 rays. Gillopenings wide, gillmembranes united at their base, free from isthmus. Branchiostegals 7—16. Gillrakers differing in genera. Pseudobranchiae none.

Fresh water of South America, Africa, Indo-Australian Archipelago and Australia.

1. Scleropages Günther.

(Günther. Ann. & Mag. Nat. Hist. XIV. 1864, p. 196).

Elongate, ventrally compressed in a trenchant edge. Scales very large. Cleft of mouth very wide, oblique. Lower jaw prominent with a pair of barbels. Maxillary very long, narrow. Jaws with a series of small teeth. Villiform teeth on vomer, palatines, pterygoids and tongue. Dorsal much shorter than anal. A distinct space between caudal and anal. Pectorals elongate. Branchiostegals numerous. Gillrakers stout, few in number, with a series of protuberances on the innerside of first branchial arch.

Synopsis of the species.

A. L. l. 21—24; L. tr. $2\frac{1}{2}$—2. Pectorals about 3 times in length of body . . . . . *S. formosus* p. 13.

B. L. l. 35; L. tr. 3—4. Pectorals more than 4 times in length of body . . . . . *S. leichhardti* p. 14.

1. Scleropages formosus (Müll. & Schl.).

Osteoglossum formosum Müller & Schlegel. Verh. Nat. Gesch. Ned. overz. Bez. Zool. Visschen. 1844, p. 1.
Osteoglossum formosum Günther. Cat. Brit. Mus. VII. 1868, p. 378.
Osteoglossum formosum Bleeker. Atl. Ichth. VI. 1866—1872, p. 145.
Osteoglossum formosum von Martens. Exp. nach Ost-Asien, Zoolog. Teil I 1876, p. 304, 312.

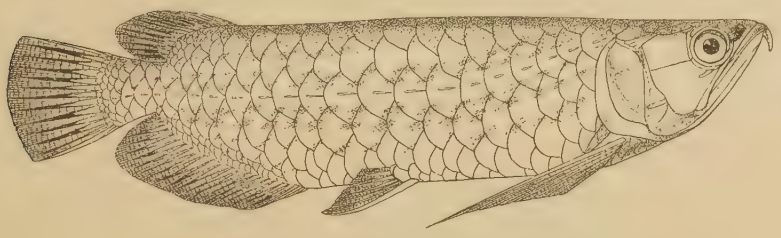

Fig. 7. *Scleropages formosus* (Müll. & Schl.).

B. 15—16; D. 20; A. 26—27; P. 7; V. 5; L.l. 21—24; L.tr. $2^1/_2$–2.

Elongate, ventrally compressed. Height $3^1/_2$-nearly 5. Head $3^1/_2$—4, eye 4—$4^1/_2$, interorbital space $1^1/_2$ diameter of eye. Postorbital part of head 2—$2^1/_2$ diameter of eye. The pointed snout shorter than the eye. Gape of mouth oblique. Chin prominent, with two stout fleshy barbels, a little shorter or longer than the eye. Maxillary reaching far behind eye. Dorsal shorter than half length of anal, as high as postocular part of head, a little higher than anal. Anal about as long as head. First produced ray of ventrals longer than postorbital part of head. Pectorals reaching base of ventrals, about 3 times in length. Scales large, with prominent reticulated lines. Eight stout gillrakers, $^1/_4$ shorter than branchial filaments, $^2/_3$ of eye; 10 protuberances on the innerside of the first branchial arch. Dorsally dark olivaceous green, the sides and ventral surface silvery or golden green, sometimes with longitudinal rows of oblique dark patches, shining through the lateral scales. Fin membranes bluish, the rays reddish brown. Length 430 mm.

Nom. indig.: Tangalasa (Kuwala Pattai), Talisso (Lampong), Mamang djawan (Laut Tador), Tangkuso (Palembang),

Habitat: Sumatra (Lampong, Palembang!, Laut Tador); Banka; Borneo! (Kuwala Pattai, Sambas, Banjermassin, Danau Sriang, Mahakan river).

Freshwater.

Buccal incubation has been recorded in this fish by FUHRMANN (Ann. Sc. Nat. Paris XX. 1905).

2. Scleropages leichhardti Günther.

Scleropages leichhardti Günther. Ann. Mag. Nat. Hist. XIV. 1864, p. 196.
Osteoglossum leichhardti Günther. Cat. Brit. Mus. VII. 1868, p. 378.
Osteoglossum jardinii S. Kent. Proc. Roy. Soc. Queensland. VIII. 1892, p. 105.
Scleropages leichhardti Max Weber. Notes Leyden Mus. XXXII. 1910, p. 226.

B. ?; D. 20; A. 31; P. ?; V. 5; L. l. 35; L. tr. 3—4.

Elongate. Height $3^3/_4$—4, equal to head, eye about 7, about as long as snout. Gape of mouth very oblique. Maxillary reaching far behind eye. Barbels very small. Pectorals more than 4 times in length. Darker above, light below, with light stripes and spots on the head and on the scales of the dorsal surface. Length 700 mm.

Habitat: New Guinea (Digul river). — Queensland.

The occurrence of this species in New Guinea is based on a photo.

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5. Fam. CHANIDAE.

Oblong, moderately compressed, head depressed. Scales cycloid, small, adherent, silvery, longitudinally striped. Head naked. Scales forming a sheet along the base of dorsal and anal. Axillary scales above and below pectorals and ventrals; a lateral line consisting of scales with a single tube. Mouth terminal, small, transverse, bordered above by intermaxillaries, which exclude from the gape the short and broad maxillaries, which have no supplemental bone. The mandibles are overlapped by the upper jaw. They have a symphysial tubercle, fitting into a notch between the intermaxillaries. No teeth. Dorsal fin opposite to ventrals, longer than short anal. Ventrals well developed, with 11—12 rays. Caudal very long, forked to the base, its upper lobe the longest. Gillmembranes totally united, free from isthmus, 4 branchiostegals. Pseudobranchiae well developed. Gillrakers in two diverging rows, exceedingly fine and numerous.

1. Chanos Lacépède.

(LACÉPÈDE Hist. Nat. d. Poissons. V, 1803, p. 395).

For characters of the single genus see those of the family.

1. Chanos chanos (Forsk.).

Mugil chanos Forskål. Descript. Anim. 1775, p. 74.
Lutodeira indica van Hasselt. Algem. Konst- en Letterbode. 1823, p. 333.
Chanos lubina Cuvier & Valenciennes. Hist. Nat. Poissons. XIX. 1846, p. 199.
Chanos salmoneus Günther. Cat. Brit. Mus. VII. 1868, p. 473.
Chanos lubina Günther. Cat. Brit. Mus. VII. 1868, p. 474.
Chanos salmoneus Bleeker. Atl. Ichth. VI. 1866—1872, p. 81.
Chanos lubina Bleeker. Atl. Ichth. VI. 1866—1872, p. 82.
Chanos salmoneus Day. Fishes. of India. 4°. 1878—1888, p. 651.
Chanos chanos Jordan & Herre. Proc. U. S. Nat. Mus. XXXI. 1906, p. 622.
Chanos salmoneus Boulenger. Trans. Linn. Soc. London (2). XII. 1909, p. 291.
Chanos chanos Günther. Fische der Südsee. Heft VIII. 1909, p. 387.

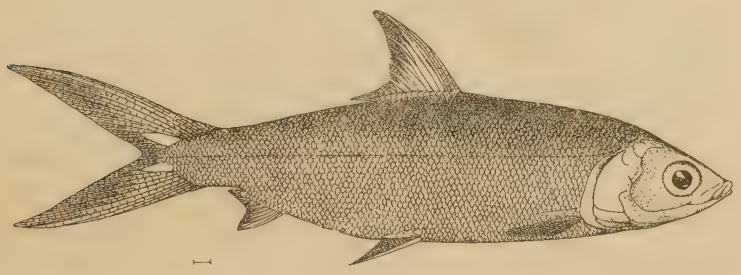

Fig. 8. *Chanos chanos* (Forsk.).

B. 4; D. 14—16; A. 10—11; P. 16—17; V. 11—12; L.l. 75—80.

Height about 4, head $3^2/_3$—$4^1/_3$, eye 3—$3^2/_3$. Silvery greenish above. Dorsal, caudal and tip of anal as well as inside of pectorals and ventrals dark. Length over 1500 mm.

Nomen indig.: Bandang (Mal.).

Habitat: Java (Bantam, Tanara, Krawang!, Batavia!, Cheribon, Gresik, Surabaya); Madura; Pinang; Borneo; Celebes (Macassar); Buru; New Guinea. — Eastward to the Paumotu islands, north to southern Japan, southward to New South Wales, westward to the Red Sea and the East coast of Africa and Madagascar.

In sea and estuaries.

Much esteemed as food and grown in tanks and ponds, the fray being procured along the coast.

6. Fam. Clupeidae.

Oblong or elongate, more or less compressed. Belly often with a serrature. Scales cycloid, sometimes with a pectinated

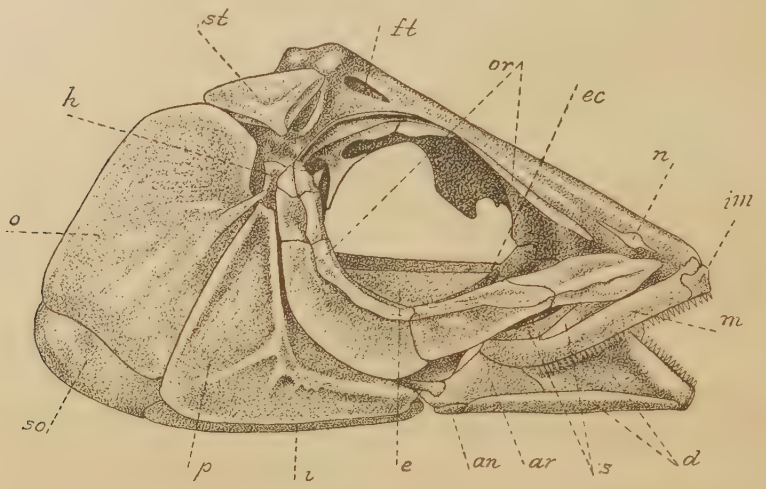

Fig. 9. Skull of *Dussumieria acuta* (after Ridewood) *an* angular, *ar* articular, *d* dentary. *e* entopterygoid, *ec* ectopterygoid, *ft* temporal foramen, *h* hyomandibular, *i* interopecular, *im* intermaxilla, *m* maxilla, *n* nasal, *o* opercular, *or* circumorbital bones, *p* preopercular, *s* supplemental bones of maxilla, *so* subopercular, *st* supratemporal.

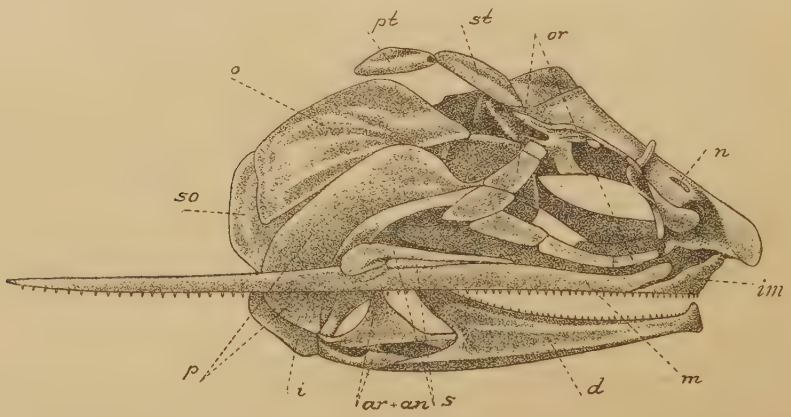

Fig. 10. Skull of *Coilia nasus* (after Ridewood). *pt* posttemporal; for other explanation of lettering see Fig. 9.

border. Head naked. Cleft of mouth small or very wide. Teeth mostly small, often feeble or wanting, very rarely cani-

niform, if present variously arranged on jaws, vomer, palatines, pterygoids and tongue. Upper jaw formed mesially by intermaxillaries and laterally by the maxillaries, the former generally small, the latter sometimes produced beyond the mandibulary joint. Dorsal rarely wanting, median or somewhat posterior. Ventrals abdominal, with 6—11 rays; they are small or may be wanting. No gular plate. Gillopening wide, gillmembranes not connected or only at their base, free from isthmus. Branchiostegals 6. Pseudobranchiae generally present, 4 gillslits. Airbladder contiguous with auditory organ.

Artificial key to the subfamilies.

A. No abdominal scutes.
- *1.* Belly sharp. Canine teeth. Scales very small . . . *Chirocentrinae* p. 17.
- *2.* Belly rounded. No canine teeth. Scales moderate. *Dussumierinae* p. 19.

B. Keeled abdominal scutes.
- *1.* Mouth small, inferior, transverse. Maxillary with one supplemental bone. No teeth. Gillmembranes separate . . . . . *Dorosomatinae* p. 23.
- *2.* Mouth large, lateral, snout prominent. Maxillary with two supplemental bones. Always teeth in jaws. Gillmembranes more or less united . . . . . *Engraulinae* p. 26.
- 3. Mouth lateral, jaws equal. Maxillary with two supplemental bones. Gillmembranes separate . . . *Clupeinae* p. 53.

1. Subfam. Chirocentrinae.

Very elongate and compressed. Scales thin, small, very deciduous. Large axillary scales above and below pectorals and ventrals. Two elongate scales on base of caudal. No abdominal scutes, but abdomen with a sharp margin. Mouth large, very oblique, bordered by large intermaxillaries and long narrow maxillaries with two supplemental bones. Mandibulary very prominent. Canine teeth in mandibulary and in front of intermaxillary, the other ones and those in maxillary long and pointed. Few teeth on palatines and tongue. Eyes subcutaneous, small. Dorsal above anterior part of long anal, ventrals very small, about midway between caudal and end of snout. Pectorals low down, folding like ventrals. Caudal deeply incised. Gillmembranes separate, free. Branchiostegals 8. Thirteen very short, strong, flattened gillrakers. No pseudobranchiae.

1. Chirocentrus Cuvier.

(Cuvier. Règne animal. 1817. p. 178).

For characters of single genus see those of the family.

1. Chirocentrus dorab (Forsk.).

Clupea dorab Forskål. Descript. Animal. 1775. p. 72.
Clupea dentex Bloch, Schneider. Systema Ichth. 1801, p. 428.
Esox chirocentrus Lacépède. Hist. Nat. Poiss. V. 1803, p. 296.
Chirocentrus dorab Cuvier & Valenciennes. Hist. Nat. Poiss. XIX. 1846, p. 150.
Chirocentrus hypselosoma Bleeker. Nat. Tijdschr. Ned. Indië. III. 1852, p. 71.
Chirocentrus dorab Günther. Cat. Brit. Mus. VII. 1868, p. 475.
Chirocentrus dorab Bleeker. Atl. Ichth. VI. 1866—1872, p. 92.
Chirocentrus hypselosoma Bleeker. Atl. Ichth. VI. 1866—1872, p. 93.
Chirocentrus dorab Day. Fishes of India. 4°. 1878—1888, p. 652.
Chirocentrus dorab Jordan & Herre. Proc. U. S. Nat. Mus. XXXI. 1906, p. 641.
Chirocentrus dorab Günther. Fische der Südsee. Heft VIII. 1909, p. 388.

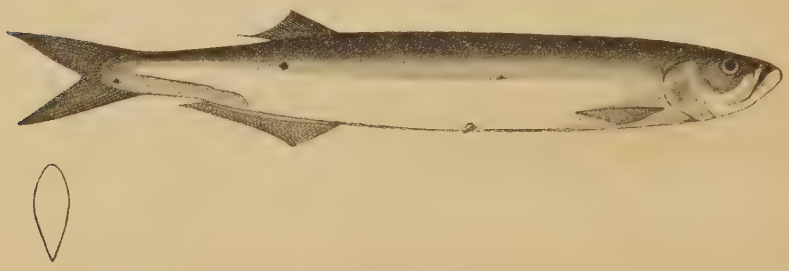

Fig. 11. *Chirocentrus dorab* (Forsk.).

B. 8; D. 16—17; A. 26—36; P. 12—14; V. 6—7.

Height $6^1/_2$—9, head 5—6, eye 4—5. Bluish black above, gradually silvery to sides and abdomen. Fins hyaline, dorsal and pectorals dusky, caudal brownish. Length 1000 mm. and more.

Nom. indig.: Parang (Mal.), Terak (Jav.), Dentobu (Buru).

Habitat: Java (Batavia!, Cheribon!, Semarang, Tegal, Surabaya); Madura!; Sumatra (Benkulen, Padang, Under Langkat); Singapore; Bintang (Rio); Banka; Borneo (Singkawang, Sampit); Celebes (Macassar, Bonthain, Sindjai); Buru (Kajeli); Batjan; Obi major; Ambon; New Guinea. — New Brittain; Queensland; Philippines; Formosa; China; Japan; Siam; British India; Red Sea; along the coast of Africa to Natal.

In sea.

2. Subfam. Dussumierinae.

Elongate, belly rounded. Scales moderate, or large, thin, deciduous. No abdominal scutes. Jaws equal or nearly so. Mouth rather small, terminal, bordered by the small intermaxillary and the long maxillary which has two supplemental bones, and is broad and rounded behind. Small teeth on jaws, vomer, palatines, pterygoids and tongue which are deciduous and may be wanting. Dorsal longer than anal, inserted opposite ventrals. Gillmembranes separate, free from isthmus; 6—15 branchiostegals. Gillrakers very fine and slender, not numerous. Pseudobranchiae present.

Synopsis of the genera.

A. Origin of dorsal nearer to end of snout than to caudal.
Anal 9—13 rays, 6 branchiostegals . . . . . *Spratelloides* p. 19.

B. Origin of dorsal nearer to caudal than to end of snout.
Anal 15—17 rays, 15—20 branchiostegals . . . . . *Dussumieria* p. 21.

1. Spratelloides Bleeker.

(Verh. Batav. Gen. XXIV, 1852, Haringachtigen p. 29).

(*Stolephorus* Jordan & Herre, nec Lac.).

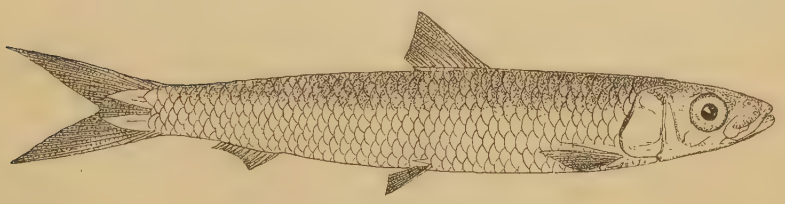

Fig. 12. *Spratelloides gracilis* Schleg.

Small, elongate, nearly subcylindrical. Tail very short. Scales large, thin, deciduous. Snout conical. Jaws equal or nearly so. Cleft of mouth small, bordered by the elongate intermaxillary and the broad maxillary which is rounded behind and which has two supplemental bones. Teeth none or very minute and deciduous on jaws, vomer, pterygoids and tongue. Dorsal short, inserted opposite ventrals, its origin nearer to end of snout than to caudal. Anal very short. Gillmembranes separate, free from isthmus. About 6 flat branchiostegals. Pseudobranchiae well developed. Gillrakers rather long.

In the indo-australian archipelago and especially at Macassar these fishes are preserved for consumption, together with species of the genus *Stolephorus*, and form a delicious con-

diment known as "ikan merah" (red fish), highly esteemed by natives as well as by Europeans in the colony.

Synopsis of the species.

I. Linea lat. 35—36. A. 9 . . . . . *S. delicatulus* p. 20.
II. Linea lat. 45. A. 13 . . . . . *S. gracilis* p. 20.

1. Spratelloides delicatulus (Benn.).

Clupea delicatula Bennett, Proc. Comm. Zool. Soc. I. 1831, p. 168.
Clupea macassariensis Bleeker, Journ. Ind. Arch. III. 1849, p. 72.
Clupeoides macassariensis Bleeker, Verh. Bat. Gen. XXIV. 1852, Haring. p. 17.
Spratelloides delicatulus Günther, Cat. Brit. Mus. VII. 1868, p. 464.
Spratelloides delicatulus Bleeker, Atl. Ichth. VI. 1866—1872, p. 96.
Stolephorus delicatulus Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 186.
Spratelloides delicatulus Günther, Fische der Südsee, Heft VIII. 1909, p. 383.

B. 6; D. 11; A. 9; P. 12; V. 8; L. l. 35—36; L. tr. 7—8.

Elongate, nearly subcylindrical. Height $4^1/_2$—6, head 4—$4^1/_4$, eye $3^3/_4$—4, as long as snout. Maxillary reaching to front-margin of eye or a little farther. Origin of dorsal nearer to snout than to base of caudal. Anal a little longer than eye, considerably shorter than ventrals, the origin of which lies nearer to the anal than to the root of the pectorals and is inserted below the middle of the dorsal. Pectorals about as long as eye and snout. Caudal deeply emarginated, 5—6 in length. Covered part of scales with 3 to 5 longitudinal lines. 26 gill-rakers, about twice as long as branchial filaments, shorter than eye. The dark bluish back well defined from the silvery sides and underside. Length 80 mm.

Nom. indig.: Kasau (Ternate), Gusan (Saparua).

Habitat: Singapore; Banka; Celebes (Macassar, Menado); Saleyer!; Kangeang!; Siau; Karkaralong islands!; Salibabu (Lirung!); Obi major!; Ambon; Saparua; between Gisser and Ceram laut!; Tiur; Banda; Ternate; Halmahera (Sindangoli); between Fau and Gebe!. — Philippines; Samoa; Bonham islands; Australia; Mauritius.

2. Spratelloides gracilis (Schl.) [Fig. 12].

Clupea gracilis Schlegel, Fauna Japonica Poiss. 1847, p. 238.
Clupea argyrotaeniata Bleeker, Journ. Ind. Arch. III. 1849, p. 72.
Spratelloides argyrotaenia Bleeker, Verh. Bat. Gen. XXIV. 1852, Haring. p. 29.
Spratelloides gracilis Günther, Cat. Brit. Mus. VI. 1868, p. 465.
Spratelloides gracilis Bleeker, Atl. Ichth. VI, 1866—1872, p. 96.
Stolephorus japonicus Jordan & Seale, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 770.
Stolephorus gracilis Evermann & Seale, Bull. Bur. Fish. XXVI. 1906, p. 53.

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Stolephorus japonicus Jordan & Herre, Proc. U. S. Nat. Mus. XXXI. 1907, p. 629. (nec Houttuyn).
Spratelloides gracilis Günther, Fische der Südsee, Heft VIII. 1909, p. 384.

B. 6; D. 12—13; A. 13; P. 11—12; V. 8; L. l. 45; L. tr. 8—9.

Height 6—7, head more than 4—4$^1/_2$, eye 3$^1/_2$—4. Snout pointed longer than eye. Maxillary reaching to frontmargin of eye or a little farther. Origin of dorsal nearer to snout than to base of caudal. Anal equal to 1$^1/_2$ times the diameter of eye, shorter than ventrals, which equal postocular part of head. Origin of ventrals nearer to anal than to root of pectorals, and below the hinderpart of the dorsal. Pectorals about as long as eye and snout. Caudal deeply emarginated 5—6 in length. Four to 6 longitudinal lines on the covered part of the scales. Twenty six gillrakers, twice as long as the branchial filaments, a little shorter than eye. Dark bluish above, silvery below. A silvery lateral band may be present. Length more than 80 mm.

Habitat: Celebes (Macassar); Kangeang islands!; Obi-major!; Nusa-laut!; Banda!; Batjan; Ternate. — Lord Howe Island; Fidji islands; Philippines; Japan; Red Sea (Eritrea).

2. **Dussumieria** Cuvier & Valenciennes.

(Hist. Nat. des Poissons XX, 1847, p. 467).

Elongate, more or less compressed. Scales moderate, thin, very deciduous. Snout pointed, jaws equal. Eyes with broad very thin adipose eyelids. Mouth bordered by the very small intermaxillaries and the maxillaries, with have two supplemental bones. Dorsal opposite to ventrals, its origin nearer to caudal than to end of snout. Anal small, far behind dorsal. Small teeth in jaws, and in villiform patches on palatines, pterygoids and tongue, none on vomer. Gillmembranes separate, free from isthmus, with 15—20 very fine branchiostegals. Pseudobranchiae large. Gillrakers rather long.

Synopsis of the species.

A. Linea lat. 40—42 . . . . . *D. acuta* p. 21.
B. Linea lat. 52—56 . . . . . *D. hasseltii* p. 23.

1. **Dussumieria acuta** C. V.

Dussumieria acuta Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1848, p. 467.
Dussumieria elopsoides Bleeker, Verh. Bat. Gen. XXII. 1849, Ichth. Madura, p. 12.
Dussumieria acuta Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1268.

Dussumieria acuta Kner, Fische der Novara Exp. 1865—1867, p. 330.
Dussumieria acuta Günther, Cat. Brit. Mus. VII. 1868, p. 466.
Dussumieria acuta Bleeker, Atl. Ichth. VI. 1866—1872, p. 94.
Dussumieria acuta Day, Fishes of India 4°. 1871—1888, p. 647.

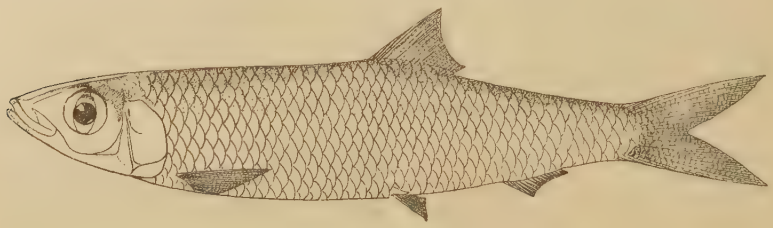

Fig. 13. *Dussumieria acuta* C. V.

B. 14—15; D. 19—20; A. 15—17; P. 14—15; V. 8.; L. l. 40—42; L. tr. 11—12.

Elongate, dorsal and ventral profile evenly convex. Height $4—4^1/_2$, head about 4, eye 3— nearly 4, $1^1/_3$ times in postorbital part of head. Snout acute, about $^1/_4$ longer than eye. Fronto-rostral line straight. Maxillary not reaching below frontmargin of eye. Jaws equal. Origin of dorsal more than diameter of eye nearer to caudal than to snout. Origin of anal far behind dorsal, about as long as postorbital part of head, shorter than ventrals, the origin of which is below the middle of the dorsal. Pectorals pointed, as long head without snout. Caudal deeply incised, about 4 times in length. Distinct teeth on jaws, palatines, pterygoids and tongue. Gillrakers about 20, with very fine spines along the innerside, as long as pupil, slightly longer than branchial filaments. Scales thin, very deciduous, longitudinally striated, their hindmargin rough or indistinctly crenulated. Elongated scales in the axil of pectorals and ventrals. Upper half dark greenish, lower half silvery. A golden lateral band from opercle to caudal. Fins hyaline, caudal with a dark margin. First ray of dorsal and pectorals with a dark spot. Length 165 mm.

Nomen indig.: Ajapu (Batavia).

Habitat: Java (Batavia!, Samarang, Surabaya, Palabuan Batu); Madura; Sumatra (Benkulen, Trussan, Padang, Tiku, Priaman); Pinang; Singapore; Bintang (Rio); Banka; Borneo (Serawak); Celebes (Macassar); Batjan; Ambon; Obi; Waigeu; New Guinea. — Philippines; China; British India to South Arabia.

In sea.

2. Dussumieria hasseltii Blkr.

Dussumieria Hasseltii Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 422 (pro parte).
Dussumieria Hasseltii Bleeker, Verh. Bat. Gen. XXIV. 1852. Chiroc. etc., p. 13.
Dussumieria elopsoides Günther, Cat. Brit. Mus. VII. 1868, p. 466 (nec Bleeker).
Dussumieria Hasseltii Bleeker, Atl. Ichth. VI. 1866—1872, p. 95.
Dussumieria Hasseltii Day, Fishes of India 4°. 1878—1888, p. 647.
Dussumieria elopsoides Jordan & Richardson, Bull. Bur. Fish. XXVII. 1908, p. 236.
Dussumieria hasseltii Jordan & Richardson, Bull. Bur. Fish. XXVII. 1908, p. 236.

B. 15; D. 18—19; A. 16; P. 14—15; V. 8; L. l. 52—56; L. tr. 12—13.

Elongate, dorsal and ventral profile evenly convex. Height 4— about 5, head $3^2/_3$, eye about 4, $1^2/_5$ times in postorbital part of head. Snout acute, about $^1/_3$ longer than eye. Maxillary nearly reaching below frontmargin of eye. Jaws equal. Origin of dorsal more than diameter of eye nearer to caudal than to snout. Origin of anal far behind dorsal, about as long as postorbital part of head. Origin of ventrals below the middle of dorsal. Pectorals pointed, about as long as postocular part of head. Caudal deeply incised. Distinct teeth on jaws, palatines, pterygoids and tongue. Gillrakers about 22—24, slightly longer than branchial filaments, about $^3/_4$ of eye, spinous at the innerside. Scales very deciduous. Elongated scales in the axil of pectorals and ventrals. Upper half dark greenish, silvery below. A golden lateral band from opercle to caudal. Fins hyaline, distal part of caudal black. First ray of dorsal and pectorals with a dark spot. Length 170 mm.

Nomen indig.: Tamban binès (Banjuwangi).

Habitat: Java (Batavia!, Cheribon, Samarang, Surabaya, Banjuwangi!); Madura; West and East coast of Sumatra; Singapore; Borneo (Balikpapan!); Celebes (Macassar); Lombok!; Batjan; Halmahera; Obi-major; Ambon. — Philippines; Formosa; China; India westward to Canara.

In sea.

3. Subfam. Dorosomatinae.

Body short and deep, strongly compressed. Scales thin, moderate, more or less adherent. Keeled and spiny abdominal scutes. Conical snout not very prominent. Mouth small, inferior (Fig. 14, m), transverse, bordered by the praemaxillaries only; above and behind them lie the narrow maxillaries which have a single supplemental bone. No teeth. Eyes with an adipose eyelid. Dorsal opposite to ventrals. Anal rather long. Pecto-

rals and ventrals moderate, each with an axillary scale. Caudal forked. Gillmembranes separate, free from isthmus. Branchiostegals 5—6. Gillrakers very numerous slender, short. Pseudobranchiae large.

Mud-eating fishes of the coasts and estuaries.

1. Dorosoma Rafinesque.

(Ichthyol. Oh. 1820, p. 34).

(*Chatoessus* C. V.).

For characters of the single genus see those of the family.

Synopsis of the species.

A. Linea lat. 46—50; Linea tr. 18—19. Last dorsal ray produced, filiform, about 140 gillrakers . . . . . *D. nasus* p. 24.

B. Linea lat. 40; Linea tr. 13—14. No dorsal ray produced, about 80 gillrakers . . . . . *D. chacunda* p. 25.

Remark. J. Karoli (Termes. füzetek V, 1882, p. 37) records *D. chanpole* (H. B.) from Singapore and Java (Palabuan), but this species is only known from Bengal.

Jordan and Seale (Bull. Bur. Fish. XXV. 1906, p. 187) cite as a locality for *Dorosoma breviceps* (Peters), from New-Hanover, also Ambon, but we cannot find any authority for this statement.

1. Dorosoma nasus (Bl.).

Clupea nasus Bloch, Ausl. Fische IX. 1795, p. 116.
Chatoessus nasus Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 104.
Chatoessus nasus Bleeker, Verh. Bat. Gen. XXIV. 1852, Haring. p. 50.
Chatoessus selangkat Kner, Novara Exp. Fische, 1865—1867, p. 337. (nec Blkr).
Chatoessus nasus Günther, Cat. Brit. Mus. VII. 1868, p. 407.
Dorosoma nasus Bleeker, Atl. Ichth. VI. 1866—1872, p. 142.
Chatoessus nasus Day, Fishes of India 4°. 1878—1888, p. 634.
Konosirus thrissa Jordan & Seale, Proc. Davenp. Ac. Sci. X. 1905, p. 2. (not *Clupea thrissa* L.)
Konosirus nasus Jordan & Herre, Proc. U. S. Nat. Mus. XXXI. 1906, p. 625.

B. 5—6; D. 15—17; A. 20—22; P. 15; V. 8; L. l. 46—50; L. tr. 18—19.

Oblong, compressed. Height 2—2 1/2, head 3 1/3—4, eye 3—3 1/2, anterior and posterior border of pupil covered by the palpebral membrane. Snout prominent, very obtuse, much shorter than eye. Maxillary reaching below the anterior part of the eye. Dorsal nearer to base of caudal than to snout, its origin

nearer to end of snout, half as high as body, acute, emarginate, its last ray thickened and setiform in adults, reaching caudal. Anal 4—4$^1/_2$ in length. Ventrals opposite to middle of dorsal, their origin nearer to anal than to suboperculum. Pectorals about as long as head, nearly reaching to ventrals. Caudal scaly, deeply incised, 4—4$^2/_5$ in length. Scales with or without transverse lines, their hindmargin serrated. About 30 keeled spiniferous abdominal scutes, 9—10 of which are postventral. About 140 short gillrakers. Silvery, above greenish, with indistinct brown longitudinal lines running along the rows of scales. A black spot on the shoulder. Length over 220 mm. (A specimen of Bleeker's collection seen by us).

Habitat: Java; Singapore; Banka; Celebes (Bulucomba); Batjan; Obi-major; Ambon; Ceram (Wahai); New-Guinea. — Australia, Philippines, Formosa, China, British India, westward to South Arabia and Sokotra.

In sea.

2. **Dorosoma chacunda** (H. B.).

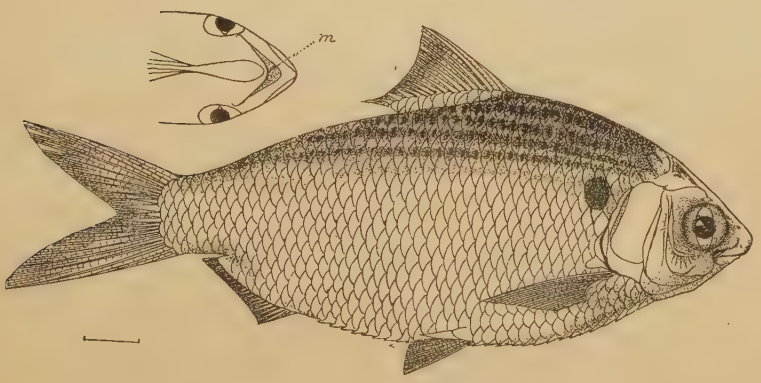

Fig. 14. *Dorosoma chacunda* H. B., upper figure underside of head, *m* mouth.

Clupanodon chacunda Hamilton Buchanan, Fishes Ganges 1822, p. 246.
Gonostoma javanicum Kuhl, van Hasselt, Algemeene Konst en Letterbode 1823, p. 329.
Chatoessus chacunda Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 111.
Anodontostoma Hasseltii Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. ichth Madura, p. 15.
Chatoessus chacunda Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1293.
Chatoessus chacunda Bleeker, Verh. Bat. Gen. XXIV. 1852. Haring. p. 46.
Chatoessus selangkat Bleeker, Verh. Bat. Gen. XXIV. 1852. Haring. p. 47.

Chatoessus chacunda Kner, Fische Novara Exp. 1865—1867, p. 337.
Chatoessus chacunda Günther, Cat. Brit. Mus. VII. 1868, p. 411.
Dorosoma chacunda Bleeker, Atl. Ichth. VI. 1866—1872, p. 143.
Chatoessus chacunda Day, Fishes of India 4°. 1878—1888, p. 632.

B. 6; D. 17—18; A. 19—20; P. 14—16; V. 8; L. l. 40; L. tr. 13—14.

Oblong slightly compressed. Ventral profile regularly rounded. Profile between dorsal and snout convex, specially above operculum. Height 2—$2^1/_2$, head $3^1/_3$—4, eye 3—$3^1/_2$, anterior and posterior palpebral membrane reaching pupil. Snout prominent, about $^3/_4$ of eye. Maxilla reaches a little farther than anterior border of pupil. Dorsal nearer caudal than snout, its origin much nearer to snout. Anal about as long as head without snout. Ventrals about as long as postorbital part of head, their origin below the middle of the dorsal, midway between anal and origin of pectorals, which are a little shorter than head, not reaching ventrals. Caudal scaly, $3^1/_4$—$4^1/_4$ in length. Scales firm, their hindborder irregular or with distinct teeth. 14—16 praeventral, 11—12 postventral abdominal keeled scutes, lastnamed with a prominent spine. About 80 short compressed gillrakers. Silvery, upper half darker with indistinct brown longitudinal lines, running along the rows of scales. A black spot on the shoulder. Fins hyaline. Length about 165 mm.

Nomen indig.: Selangkat, Trubala (Mal.); Penden, Slamat, Lakar (Javan.); Bandring, Djangan (Madura); Belo (Sunda); Pias (Bagan Api Api).

Habitat: Java (Batavia!, Bantam, Tegal, Surabaya, Pasuruan, Tjilatjap!); Madura; Bali; Sumatra (Telokbetong, Palembang, Bagan Api Api!); Nias!; Pinang; Singapore; Bintang (Rio); Banka; Borneo (Sambas, Pamangkat, Sinkawang, Balikpapan!, Kota baru!); Celebes (Macassar); Halmahera (Sindangola); Ambon, New Guinea. — Philippines, Siam, Burma to British India.

In sea.

4. Subfam. Engraulinae.

Oblong or elongate, more or less compressed. Scales moderate or large, thin, deciduous. Belly sharp or rounded, with more or less numerous keeled abdominal scutes. Snout prominent, mouth very large, bordered by the very small inter-

maxillaries which do not meet in a symphysis, and by the long narrow maxillary which may be produced and which has two supplemental bones. Teeth in a single row in the jaws, usually small, rarely caninoid. Small teeth on vomer, palatines, pterygoids and tongue. Dorsal rather short, above or before anal, which is usually long. Gillmembranes more or less united, free from isthmus. Seven to 19 branchiostegals. Gillrakers long and slender. Pseudobranchiae present.

Synopsis of the Genera.

I. Caudal forked, not united with the anal.

A. Scutes at least between pectorals and anal. Silvery hue is missing only on back.

a. Upper pectoral ray produced. A. 50—75 and 2—2 1/2 in length . . . . . *Setipinna* p. 27.

b. No pectoral ray produced. A. 30—50, 3—5 in length.

1. teeth in jaws partly caninoid. L. l. 50. Origin of D. behind origin of A . . . . . *Lycothrissa* p. 31.

2. teeth in jaws not caninoid. L. l. 35—45. Origin of D. before origin of A. . . . . *Engraulis* p. 32.

B. Scutes only between pectorals and ventrals. Silvery hue limited to a lateral band . . . . . *Stolephorus* p. 43.

II. Caudal pointed, united with the very long anal. Tail long and tapering. A. 62—116, 1 1/2—2 1/4 in length. Upper pectoral rays produced . . . . . *Coilia* p. 48.

1. **Setipinna** Swainson.

(Nat. Hist. II. 1839, p. 186).

Oblong to elongate, very compressed. Head small, scales moderate, thin more or less deciduous with fine undulating lines which may form a network. Abdominal scutes from the throat to the anus. Dorsal with a short pungent spine, its origin before or behind origin of anal. Anal very long, with 50—66 rays. Upper pectoral ray more or less produced. Cleft of mouth very oblique, maxillary not reaching much farther than mandibular joint. Teeth on jaws, vomer, palatines, pterygoids and tongue. Gillrakers widely set, not more than 18, with spines on the innerside. Radii branchiostegi numerous.

Synopsis of the species.

I. Origin of anal before origin of dorsal, 9—12 gillrakers, more than 50 scales in L. l.
   a. Upper pectoral ray not reaching anal, snout prominent. D. I. 12—14; A. 50—53 . . . . . *S. melanochir* p. 28.
   b. Upper pectoral ray reaching to middle of anal or even farther. Chin prominent. D. I. 17; A. 60—66. *S. brevieeps* p. 29.

II. Origin of anal below dorsal. 18 gillrakers. Less than 50 scales in L. l. Snout prominent. Upper pectoral ray produced beyond origin of anal, mostly to its posterior half. D. I. 13—15; A. 51—56 . . . . . *S. taty* p. 30.

1. Setipinna melanochir (Blkr.),

Engraulis melanochir Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 13.
Engraulis melanochir Günther, Cat. Brit. Mus. VII. 1868, p. 400.
Setipinna melanochir Bleeker, Atl. Ichth. VI. 1866—72, p. 136.

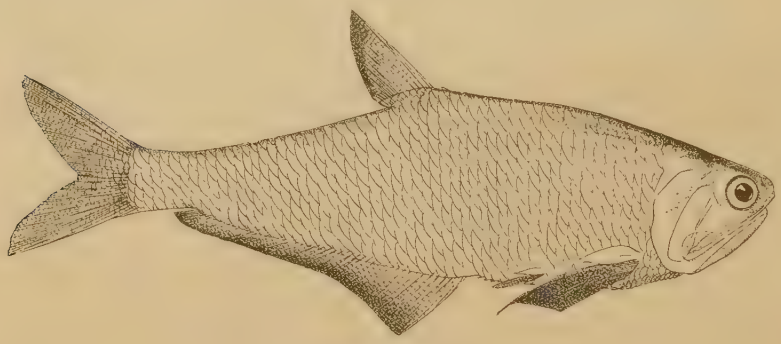

Fig. 15. *Setipinna melanochir* Blkr.

B. 12—13; D. 1, 12—14; A. 50—53; P. 1. 13; V. 7; L. l. 50—53; L. tr. 14—15.

Oblong, strongly compressed, abdominal profile slightly more convex than dorsal, slightly concave along upper profile of head. Height 3—$3^1/_2$, head $4^1/_2$—$5^2/_5$, eye $3^1/_2$—5, $^1/_4$ longer than snout, which projects before mandible. Maxillary dilated, concavely truncated behind, extending to the mandibulary joint. Origin of dorsal behind origin of anal, nearer to caudal than to snout. Anal about as long as its distance from the eye. Origin of ventrals about midway between anal and base of pectorals. Ventrals about as long as postorbital part of

head. Pectorals without their produced ray a little longer than head; the produced ray not surpassing ventrals. Caudal deeply forked, $4^1/_2$—5 in length. Small teeth on vomer, palatines, pterygoids, tongue and lower jaw, those in the maxillary stronger and distant. Nine to ten flattened, blunt very distant gillrakers, hindermost the thinnest, double as long as branchial filaments, nearly equalling eye, with unequal spines at the inner side. Scales thin, rather deciduous, with fine undulated transverse lines. A long axillary scale above pectorals and ventrals. Base of fins scaly, 29—30 abdominal scutes, the 14 praepectoral and the 7 postventral ones are more prominent. Yellowish with a silvery hue, back darker. Fins hyaline. Margin of dorsal, anal and caudal frequently dark powdered. Pectorals and often ventrals more or less black, especially in adults. Length to about 230 mm.

Nomen indig.: Siamis (Palembang).

Habitat: Java (Surabaya); Madura; Sumatra (Palembang! Djambi! Bagan api api!, Lematan-Enim); Borneo (Banjermassin, Pamangkat, Sambas, Bunut! Sarawak (Karoli)). — Siam (Sauvage); China (Sauvage).

Fresh and brackish water.

2. Setipinna breviceps (Cantor).

Engraulis breviceps Cantor, Journ. Asiatic Soc. of Bengal vol. XVIII. 1850, p. 1288.
Engraulis Pfeifferi Bleeker, Nat. Tijdschr. Ned. Indië. III. 1852, p. 433.
Engraulis breviceps Günther, Cat. Brit. Mus. VII. 1868, p. 401.
Setipinna breviceps Bleeker, Atl. Ichth. VI. 1866—72, p. 137.
Coilia Pfeifferi Sauvage, Bull. Soc. Philom. (7), VI. 1882, p. 175.
Engraulis breviceps Day, Fishes of India 4°. 1878—88, p. 628.

B. 17—19; D. 1. 17; A. 60—66; P. 1. 12—13; V. 7; L. l. 54—56; L. tr. 14.

Elongate, dorsal profile much more convex between head and dorsal than ventral which is nearly straight. Height $3^1/_2$—$3^4/_5$, head $5^3/_4$—$6^1/_4$, eye subcutaneous, 5—6, little longer than snout. Cleft of the mouth very oblique, chin forming the most prominent part of head. Maxillary rounded behind, reaching to mandibular joint. Origin of dorsal a little nearer to snout than to caudal, far behind origin of anal, the length of which is more than twice its distance from the head. Ventrals nearer to head than to origin of anal. Pectorals with the upper ray produced, and reaching to the middle or the hind-

part of the anal. Caudal deeply incised, 4—5 in length. Very small teeth on vomer, palatines, pterygoids and larger ones in the jaws. Gillrakers about 12, as long as the eye, with a row of unequal curved spines on the innerside. Scales thin not very deciduous, with a very fine network and irregular rough hindborder. 27—28 abdominal sharp pointed prominent scutes, 11 of which are postventral. Silvery, back darker. Vertical fins with a black margin, which may be broad on dorsal and caudal, even the pectoral sometimes black. Length over 300 mm.

Nomen indig.: Biang-Biang (Bagan api api).

Habitat: Pinang; Sumatra (Banjuasin, Bagan api api!); Borneo (Pontianak, Sungiduri, Sinkawang, Pamangkat, Matang, Sarawak). — Pulu Condor; Bay of Bengal.

In sea and rivers.

3. Setipinna taty (C. V.).

Engraulis taty Cuvier & Valenciennes, Hist. Nat. Poissons. XXI. 1848, p. 60.
Engraulis telaroides Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 13.
Engraulis taty Cantor, Journ. Asiat. Soc. of Bengal, vol. XVIII, 1850, p. 1288.
Engraulis taty Günther, Cat. Brit. Mus. VII. 1868, p. 400.
Setipinna taty Bleeker, Atl. Ichth. VI, 1866—72, p. 136.
Engraulis taty Day, Fishes of India 4°. 1878—88, p. 628.

B. 12; D. 1. 13—15; A. 51—56; P. 1. 12—13; V. 7; L. l. 40—46; L. tr. 12.

Oblong, strongly compressed, dorsal and ventral profile evenly convex. Height about 3, head $4^3/_4$—$5^3/_4$, eye subcutaneous, $3^1/_2$—4, $1^1/_2$ to nearly twice as long as snout, which slightly projects. Maxillary broad and obliquely truncated behind, extending a little beyond mandibulary joint. Origin of dorsal about the length of the head, nearer to snout than to caudal, far in front of origin of anal, which is about as long as its distance from the snout. Ventrals about midway between suboperculum and anal. Their origin about their length before origin of dorsal. Upper pectoral ray produced beyond origin of anal, mostly to its posterior half. Caudal deeply incised, 4 in length. Fine teeth on vomer, palatines, pterygoids, tongue and jaws. Eightteen distant gillrakers, which are irregularly spinulated along their innerside, thrice as long as branchial filaments. Scales thin, more or less deciduous, with a network narrowing near the hindborder and ending there in parallel

lines. They cover dorsal, anal and caudal. Large axillary scales at pectorals and ventrals. Abdominal scutes 30—32, the 10 postventral and the praepectoral ones being the most prominent. Yellowish with silvery hue. Fins hyaline. Length to 170 mm.

Habitat: Java (Batavia!, Surabaya, Pasuruan); Madura; Sumatra (Benkulen); Pinang; Singapore; Banka; Borneo (Pamangkat, Sinkawang, Sungiduri, Pontianak, Sarawak, Balik papan!). — Westward to British India.

In sea and estuaries.

2. **Lycothrissa** (Günther) Bleeker.

(Günther. Cat. Brit. Mus. VII, 1868, p. 399 as subgenus. Bleeker, Atl. ichth. VI. 1866—1872, p. 125).

Elongate, compressed. Scales moderate, thin, deciduous, with irregular curved transverse lines. Not very prominent abdominal scutes only between pectoral and anus. Snout prominent. Mouth oblique. Head small. Maxillary narrow, extending to the mandibular joint, its supplementary bone only partially ossified. Origin of dorsal behind origin of anal, which is very long. Upper pectoral ray not produced. Small teeth on vomer, palatines, pterygoids and tongue, those in the jaws caninoid, especially the few of the lower jaw.

Lycothrissa crocodilus (Blkr.).

Engraulis crocodilus Bleeker, Nat. Tijdschr. Ned. Indië, I. 1851, p. 15.
Engraulis crocodilus Günther, Cat. Brit. Mus. VII, 1868, p. 400.
Lycothrissa crocodilus Bleeker, Atl. Ichth. VI. 1866—1872, p. 125.

Fig. 16. *Lycothrissa crocodilus* Blkr. $^1/_2$ n. s.

B. 12; D. I. 12—13; A. 46—48; P. I. 13—14; V. 7; L. l. 46—50; L. tr. 10—11.

Elongate, compressed, abdominal profile convex, dorsal

nearly straight, specially on the head which has a longitudinal keel. Height 4—4 1/3, head 4 2/3—5, eye 4—4 4/5, 1/4—1/3 longer than snout, which only slightly projects beyond the under jaw, situated in the anterior half of the head. Maxillary narrow, obtusely pointed behind, extending to the mandibular joint. Origin of dorsal midway between head and root of caudal, or a little nearer to lastnamed, behind origin of anal, which is as long as its distance from the head. Ventrals midway between anal and suboperculum, or nearer to the head. Pectorals about as long as head without snout, reaching beyond the root of the ventrals. Caudal deeply forked. Teeth on vomer, palatines, pterygoids and tongue. In the maxillary are series of distant caninoid teeth, curved inwards, irregularly alternating with similar but flexible teeth. In the lower jaw 6—14 still larger caninoid teeth, between which a series of small nearly invisible teeth in the gum. About 10 stout curved flattened spinous gillrakers, a little longer than the branchial filaments, about as long as the pupil. Scales thin, deciduous, with irregular and irregularly curved transversal lines. Long axillary scales at pectorals and ventrals. About 17—18 abdominal scutes behind pectorals, 10 of which postventral. Silvery. Length more than 280 mm.

Habitat: Borneo (Banjermassin, Pontianak, Sinkawang, middle-course of Kapuasriver); Sumatra (Banjuasin, Palembang, Djambi!). — Siam.

Brackish and freshwater.

4. **Engraulis** Cuvier.

(Cuvier, Règne animal. Ed. I, 1817, p. 174).

Oblong or elongate, compressed. Scales moderate, more or less deciduous. Abdominal scutes always between pectorals and anus, mostly also before pectorals. Maxillary more or less produced, sometimes even surpassing ventrals [Fig. 18]. Mouth oblique. Origin of dorsal before origin of anal, which is rather long (27—50 rays), and goes 2 2/3—4 times in length. Upper pectoral ray not produced. Teeth on jaws, vomer, palatines, pterygoids and tongue. No caninoid teeth.

Synopsis of the species.

I. Ventral keel before pectorals without scutes. Anal behind dorsal. Gillrakers 20—22 . . . . . *E. baelama* p. 33.

II. Keeled scutes from mouth to anus.

A. Maxillary not extended beyond gillopening.

a. Origin of anal distinctly behind end of dorsal, gillrakers 20 or more.

1. 20 gillrakers, maxillary not reaching gillopening . . . . . *E. scratchley* p. 34.

2. 21—27 gillrakers, maxillary reaching gillopening.

α. 27 gillrakers, 23 ventral scutes, snout equal to eye, very prominent. . . . . *E. kammalensis* p. 35.

β. 21—25 gillrakers, 27 ventral scutes, snout $^3/_4$ of eye, slightly produced . . . . . *E. malabaricus* p. 36.

b. Origin of anal below or slightly behind end of dorsal, gillrakers 13, maxillary reaching gillopening . . . . . *E. grayi* p. 37.

B. Maxillary reaching at least to pectorals.

a. Anal below or a little behind end of dorsal.

1. Maxillary reaching root of pectorals.

α. Anal more than 3 times in length, gillrakers 13 . . . . . *E. mystax* p. 38.

β. Anal $2^2/_3$ times in length, gillrakers 17 . *E. purava* p. 39.

2. Maxillary reaching farther than pectorals.

α. Maxillary surpassing ventrals, 28 ventral scutes, gillrakers 12 . . . . . *E. setirostris* p. 40.

β. Maxillary reaching ventrals or nearly so, 25 ventral scutes, gillrakers 18. . . . . *E. dussumieri* p. 41.

b. Anal before end of dorsal . . . . . *E. valenciennesi* p. 42

1. Engraulis baelama (Forsk.).

Clupea baelama Forskål, Descript. Animal. 1775, p. 72.
Clupea baelama Bloch, Schneider, Syst. Ichthyol. 1801, p. 429.
Engraulis baelama Cuvier & Valenciennes, Hist. Nat. Poiss. XXI. 1848, p. 35.
Stolephorus encrasicholoides Bleeker, Ned. Tijdschr. Dierk. I. 1863, p. 236.
Engraulis encrasicholoides Kner, Novara Exp. Fische 1865—1867. p. 333.
Engraulis encrasicholoides Günther, Cat. Brit. Mus. VII. 1868, p. 387.
Engraulis boelama Günther, Cat. Brit. Mus. VII. 1868, p. 393.
Engraulis boelama Bleeker, Atl. Ichth. VI. 1866—1872, p. 130.
Engraulis encrasicholoides Bleeker, Atl. Ichth. VI. 1866—1872, p. 130.
Engraulis boelama Klunzinger, Verh. d. zool. bot. Ges. Wien. XXI. 1871, p. 597.
Engraulis boelama Günther, Proc. Zool. Soc. London. 1871, p. 671.
Engraulis boelama Day, Fishes of India 4°. 1878—1888, p. 626.
Engraulis boelama Günther, Fische d. Südsee, Heft VIII. 1909, p. 379.

B. 11—13; D. I. 15; A. 27—30; V. 7; P. 12—14; L. l. 36—38; L. tr. 9.

Oblong, compressed, dorsal and ventral profile nearly evenly convex. Height $3^2/_3$—4, head $3^3/_5$—4. Rostro-frontal profile convex. Eye 4—$4^3/_5$, as long as or longer than snout, which is very prominent, about $2^1/_2$ times in postorbital part of head. Maxillary obliquely rounded behind, reaching a little farther than the mandibulary joint. Upper surface of head with a median keel and with striae and rows of tubercles. Origin of dorsal, which is behind the origin of ventrals, nearer to snout than to caudal. Height of acute dorsal equalling twice its length, much longer than postorbital part of the head. Upper border of dorsal not emarginate. Origin of anal behind dorsal, its length $3^1/_2$ to about 4 in length of body. Ventrals about midway between anal and praeoperculum, about half the length of the head. Pectorals about as long as the postorbital part of the head, reaching to the ventrals or nearly so far. Jaws with a row of crowded conspicuous teeth. Small teeth on palatines, pterygoids and tongue, a few stronger on the vomer. 20—22 gillrakers, a little flattened, finely spinulated, double as long as branchial filaments, a little shorter than eye. Scales thin, not readily deciduous, with vertical lines, and a narrow network of lines in the posterior half. Hind-border irregularly indentated. About 15 abdominal scutes between pectorals and anus, feebly keeled and pointed behind, generally also a single keeled scute just behind isthmus. Silvery, back dark, generally with a dark patch on the shoulder. Fins hyaline, caudal margined with darker. Length nearly 140 mm.

Nomen indig.: Teri (Mal. Batavia); Tjangkok (Sundan.); Kendui (Madura); Lungrah (Saparua); Puri merah (Ambon); Merah, Ligoh (Batjan); Lompeh (Menado).

Habitat: Java (Batavia, Bantam, Tjiringin, Djongkulon, Surabaya, Prigi); Sumatra (Benkulen, Trussan, Priaman, Padang); Nias!; Madura; Bali; Lombok!; Celebes (Bonthain, Bulucomba, Menado, Tanawanko); Timor; Ternate; Batjan; Ambon; Saparua; Ceram; Banda; Aru-islands!; Misol; New Guinea. — Philippines, Guam, Andamans, British India, Red Sea, coast of Zanzibar, Seychelles, Mauritius and Madagascar.

In sea.

2. **Engraulis scratchleyi** Ramsay & Ogilby.

Engraulis scratchleyi, Ramsay & Douglas Ogilby, Proc. Linn. Soc. N. S. Wales ser. 2. I. 1886, p. 18.
Anchovia scratchleyi Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 188.
Engraulis scratchleyi M. Weber, Nova Guinea IX. 1913.

D. I. 12; A. 34—41; P. 13; V. 7; L. l. 38—43; L. tr. 10.

Elongate, compressed, dorsal and ventral profile nearly equal. Height $3^3/_4$—4, head about $4^3/_5$, eye $3^1/_3$ to more than 4. Snout bluntly rounded, prominent, about $^3/_4$ of eye. Maxillary obliquely truncated behind, its end reaching farther than mandibulary joint. Dorsal a little nearer to snout than to caudal. Its origin far behind origin of ventrals. Its height about twice its length, which is nearly equal to length of head. Anal $2^4/_5$—3 in length, its origin behind dorsal. Ventrals $1^1/_4$ to more than $1^1/_2$ diameter of eye. Their origin about midway between anal and mandibulary joint. Pectorals as long as head without snout, reaching to ventrals. Fine teeth on jaws, vomer, palatines, pterygoids and tongue. Twenty gillrakers, rather stout, flattened, with strong spines at the innerside, double as long as branchial filaments, more than $^3/_4$ of eye. Scales rather adherent, with some fine vertical lines, some of which are anastomosing at the hindborder. About 25—26 abdominal scutes, beginning at the throat, the 10—11 postventral ones the most prominent. Silvery, back darker, separated by a more or less faint steel blue band. Length to 350 mm.

Habitat: South-New Guinea (Lorentz river, Strickland river). — In freshwater.

3. Engraulis kammalensis Blkr.

Engraulis kammalensis Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 13.
Engraulis rhinorhynchos Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 40.
Engraulis rhinorhynchus Kner, Fische Novara Exped. 1865—67, p. 334.
Engraulis rhinorhynchus Günther, Cat. Brit Mus. VII. 1868, p. 394.
Engraulis kammalensis Day, Fishes of India 4°. 1878—88, p. 626.

B. 10—11; D. I. 13—14; A. 32—35; P. 11—12; V. 7; L. l. 35—38; L. tr. 9—10.

Oblong, compressed, ventral profile more convex than dorsal. Height $3^1/_4$—$3^2/_5$, head $3^3/_4$—4, eye 3—$3^1/_2$, about as long as snout, which is very prominent. Maxillary delated above the mandibular joint, tapering behind, extending to the gill-opening. Upper surface of head with a median keel. Origin of dorsal, which is behind origin of ventrals, about midway between snout and base of caudal. Height of dorsal twice its length, about equal to head without snout. Origin of anal behind origin of dorsal, its length about 3 times in length of body. Ventrals about midway between anal and suboper-

culum, less than half length of head. Pectorals as long as or a little longer than postorbital part of head, reaching to base of ventrals. Teeth on jaws, vomer, palatines, pterygoids and tongue. Twenty seven spinulous gillrakers, as long as the eye. Scales thin, not readily deciduous, with anastomosing lines forming a fine network on the hinder part of the scales. Twenty three abdominal scutes, which extend to before pectorals, 8 of which are postventral. Silvery, darker above. Generally a blackish spot across the nape, reaching downwards to the scapula. Fins hyaline, dorsal and caudal generally blackish along their margin. Length to 112 mm. (A specimen of Bleeker's collection seen by us).

Habitat: Java (Batavia, Surabaya); Madura; Bali; Banka; Sumatra (Benkulen); Singapore; Borneo (Sampit, Sinkawang, Sarawak); Celebes (Menado, Badjoa). — Philippines, Cebu (A. B. Meyer); Pongoor, Malacca (Peters); China (Sauvage); Bay of Bengal and Ceylon.

In sea and estuaries.

4. Engraulis malabaricus C. V.

Engraulis malabaricus Cuvier & Valenciennes, Hist. Nat. Poissons, XXI, 1848, p. 63.
Engraulis malabaricus Günther, Cat. Brit. Mus. VII, 1868, p. 395.
Engraulis malabaricus A. B. Meyer, Ann. Soc. Esp. de Hist. Nat. t. XIV, 1885, p. 42.
Engraulis malabaricus Day, Fishes of India. 4°. 1878—1888, p. 625.

B. XII; D. 1 + 14—15 $\left(\frac{2—3}{12}\right)$; P. 14; V. 7; A. 40—43 $\left(\frac{2—3}{38—40}\right)$; C. 20; L. l. 39—40; L. tr. 11—12.

"Length of head 5, of caudal $5^1/_2$, height of body $3^3/_4$ in the total length. *Eyes* — subcutaneous, diameter $4^1/_2$ in the length of head, $^3/_4$ of a diameter from end of snout, and $1^1/_2$ apart. Snout slightly in advance of the lower jaw. Maxilla dilated above the mandibular joint, it extends posteriorly to the gill-opening. *Teeth* — fine ones in the jaws and on the palate. *Fins* — dorsal commences rather nearer to the snout than to the base of the caudal fin. Anal commences behind the vertical from the last dorsal ray. Pectoral reaches the base of the ventral. *Scales* — regularly arranged: 17 scutes before and 9 or 10 behind the base of the ventral fin. Gillrakers about $^1/_2$ the length of the eye, from 21 to 25 on the horizontal branch of the outer branchial arch. Pseudobranchiae rudimentary.

Colours — silvery shot with gold and purple: black venules on the shoulder, fins yellow: dorsal and end of caudal edged with dark. Pectoral sometimes, but not usually, black." (After Day).

Habitat: North Celebes (A. B. Meyer). — Coast of Sind and through the seas of India.

In sea.

5. Engraulis grayi Blkr.

Thryssa poorawah Cuvier, Règne animal. Ed. de luxe, p. 280 (no description).
Thrissa Hamiltonii Gray, Illustr. Indian Zool. II. 1830—1835. Pisc. tab. 5, fig. 3 (figure only).
Engraulis Grayi Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 41.
Engraulis Grayi Kner, Fische Novara Exp. 1865—1867, p. 333.
Engraulis Hamiltonii Günther, Cat. Brit. Mus. VII. 1868, p. 395. (S. Syn.).
Stolephorus Hamiltoni Bleeker, Ned. Tijdschr. Dierk. I. 1863, p. 261.
Engraulis poorawah Bleeker, Atl. Ichth. VI. 1866—1872, p. 132.
Engraulis Hamiltonii Day, Fishes of India, 4°. 1878—1888, p. 625.
Engraulis Hamiltoni Vinciguerra, Ann. Mus. Civ. Genova (2) II. 1885, p. 94 and (2) IX. 1890, p. 350.
Trichosoma Hamiltoni Rutter, Proc. Acad. Nat. Science Philadelphia 1897, p. 66.
Anchovia Hamiltoni Jordan and Richardson, Bull. Bur. Fish. XXVII. 1908, p. 236.

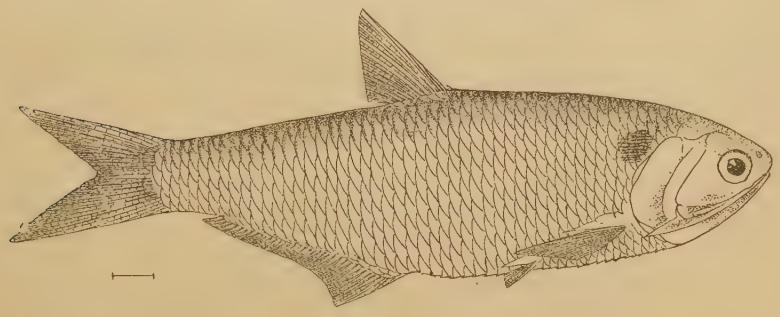

Fig. 17. *Engraulis Grayi* Blkr.

B. 12—13; D. 1. 14—15; A. 36—40; P. 12—13; V. 7; L. l. 45—47; L. tr. 12—13.

Oblong, compressed, dorsal and ventral profile about equally convex. Fronto-rostral profile slightly convex. Height about 3—$3^3/_4$, head 4—$4^4/_5$, eye $3^3/_4$—4. Snout rounded, scarcely prominent, about $^3/_4$ of eye. The maxillary is delated above the mandibular joint and its posterior tapering portion extends as far as the branchial opening. Dorsal very much nearer to

caudal than to snout. Its origin about midway between snout and caudal, situated far behind base of ventrals. Its height nearly double as long as its length, equalling head without snout. Anal about 3 times in length. Its origin below or a little behind end of dorsal. Ventrals equalling $1^1/_2$ diameter of eye, their origin about midway between anal and praeoperculum. Pectorals about as long as head without snout, reaching ventrals. Caudal deeply incised, its acute lobes $3^1/_2$—4 in length. Small teeth on jaws, vomer, palatines, pterygoids and tongue. Gillrakers 13, stout, flattened, distinctly spinulated at the innerside, $^1/_3$ longer than branchial filaments, $^3/_4$ of eye. Scales with vertical lines, which anastomose on the hindpart, where they run parallel in a longitudinal direction to the hindborder. 26 abdominal scutes beginning at throat, with a not very prominent keel ending in a spine, 10—11 of which behind ventrals. Silvery, back dark. Scapulary region with black venules. Lower part of head powdered with black. Fins hyaline, caudal with a darker margin. Length: over 200 mm.

Habitat: Java (Batavia, Bantam); Sumatra (Priaman, Palembang, Bagan api api !); Singapore; Bintang (Riouw); Banka; Borneo (Sinkawang, Sungiduri, Sarawak); Celebes (Macassar, Badjoa); Batjan; Ceram (Wahai). — Australia; Philippines; Formosa; China; Siam; Burma to Sind.

In sea and estuaries.

6. **Engraulis mystax** (Bl. Schn.).

Clupea mystax Bloch, Schneider, Systema Ichthyol. 1801, p. 426.
Thryssa porava Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 14.
Engraulis mystacoides Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 42.
Engraulis hamiltoni Kner, Fische Novara Exp. 1865—1867, p. 334.
Engraulis mystacoides Günther, Cat. Brit. Mus. VII. 1868, p. 396.
Engraulis mystax Bleeker, Atl. Ichth. VI. 1866—1872, p. 132.
Engraulis mystax Day, Fishes of India 4°. 1878—1888, p. 625.
Trichosoma porava Rutter, Proc. Acad. Nat. Sc. Philadelphia 1897, p. 65.

B. 12—14; D. 1. 14—15; A. 36—38; P. 12—13; V. 7; L. l. about 45; L. tr. 12.

Oblong, compressed, ventral profile more convex than dorsal, which is nearly straight. Height $3^2/_3$—4, head about 4, eye $3^3/_4$—4. Snout rounded, very little prominent, about $^3/_4$ of eye. Maxillary dilated above the mandibulary joint, tape-

ring behind and reaching pectorals. Dorsal very much nearer to caudal than to snout. Origin of dorsal a little nearer to caudal than to end of snout, situated far behind base of ventrals. Its height $1^1/_2$ times its length, about as long as snout and eye. Anal more than 3 times in length, its origin below or a little behind end of dorsal. Ventrals $1^1/_2$ times the diameter of eye, their origin midway between anal and mandibulary joint. Pectorals equalling head without snout, reaching ventrals. Caudal deeply incised, its lobes 4 times in length. Small teeth on jaws, vomer, palatines, pterygoids and tongue. About 13 strong flattened gillrakers, conspicuously spinulated along the innerside. Scales thin, not readily deciduous, with vertical lines forming a network on the hindpart of the scales, which have a rough irregular hindborder. About 28 abdominal scutes, beginning at the throat, keeled and pointed behind, especially the 12 postventral ones. Silvery, back dark. Scapulary region with black venules. Lower part of head powdered with black. Fins hyaline, caudal with a darkish margin. Length 190 mm.

Nomen indig.: Bulu ajam (Batavia).

Habitat: Java (Batavia!, Bantam, Tjilatjap, Semarang, Surabaya, Pasaruan); Madura; Sumatra (Benkulen, Priaman, Tiku); Singapore; Banka, Borneo (Sinkawang); North Celebes. — China; British India.

In sea and estuaries.

7. **Engraulis purava** (Ham. Buch).

Clupea purava Hamilton, Buchanan, Fishes Ganges 1822, p. 238, 382.
Engraulis purava Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 65.
Engraulis purava Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1290.
Engraulis purava Günther, Cat. Brit. Mus. VII. 1868, p. 397.
Engraulis purava Bleeker, Atl. Ichth. VI. 1866—1872, p. 135.
Engraulis purava Day, Fishes of India 4°. 1878—1888, p. 628.

B. 12; D. 1. 13; A. 45—50; P. 14—15; V. 6—7; L. l. 46; L. tr. 12.

Oblong, compressed. Height about 4, head about 5, eye $4^1/_2$—5. Snout prominent, $^3/_4$ of eye. The maxillary is dilated above the mandibulary joint and its posterior tapering portion extends to the root of the pectoral. Origin of dorsal midway between snout and caudal or a little nearer to the latter, far behind base of ventrals. Anal $2^2/_3$ in length of body.

Its origin below last rays of dorsal. The pectorals reach the ventrals. Caudal deeply incised. Seventeen gillrakers, shorter than the eye. About 27 abdominal scutes, beginning at the throat, 10—11 of which are postventral. Silvery, back dark, fins hyaline. Length 200 mm. [Not seen by us].

Habitat: Pinang. — Rangoon; both sides of India; Sind. In sea and estuaries.

8. **Engraulis setirostris** (Brouss.).

Clupea setirostris Broussonet, Ichthyol. Dec. I, 1782.
Engraulis setirostris Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 69.
Thryssa macrognathus Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 14.
Stolephorus setirostris Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 291.
Engraulis setirostris Günther, Cat. Brit. Mus. VII. 1868, p. 397.
Engraulis setirostris Bleeker, Atl. Ichth. VI. 1866—1872, p. 134.
Engraulis setirostris Day, Fishes of India 4°. 1878—1888, p. 626.
Anchovia setirostris Jordan & Richardson, Bull. Bur. Fish. XXVI. 1908, p. 237.
Engraulis setirostris Günther, Fische der Südsee, Heft VIII. 1909, p. 379.

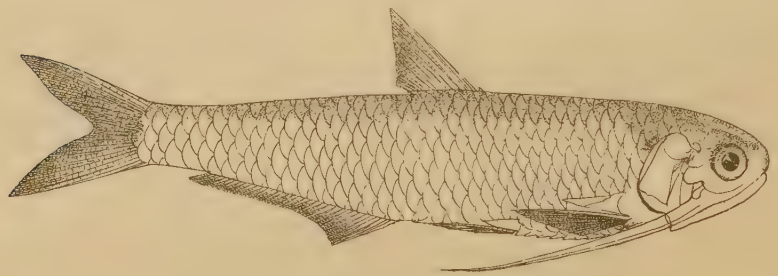

Fig. 18. *Engraulis setirostris* (Brouss.).

B. 10—11; D. 1. 14—16; A. 34—38; P. 12—14; V. 6; L. l. 40—44; L. tr. 10—11.

Elongate, compressed, dorsal and ventral profile about equal. Fronto-rostral profile convex. Height $3^4/_5$ to more than 4, head $4^3/_5$—$5^1/_5$, eye $3^1/_2$—4. Snout bluntly rounded, hardly projecting, $^3/_4$ of eye. Maxillary strongly dilated at the mandibulary joint, produced in a long filament, surpassing ventrals and often reaching anal. Dorsal much nearer to caudal than to snout. Its origin far behind origin of ventrals, about in the middle between both. Its height about twice its length, as long as head without snout. Anal about 3 in length. Its origin below last dorsal ray. Ventrals more than twice the

length of eye; nearer to anal than to suboperculum. Pectorals as long as head without snout, reaching to ventrals or not so far. Caudal deeply incised, about 4 times in length. Fine teeth on jaws, vomer, palatines, pterygoids and tongue. Twelve slender gillrakers, a little flattened, with fine spinules at the innerside, $^1/_4$ longer than branchial filaments, more than $^3/_4$ of eye. Scales thin, deciduous, with 10—12 vertical lines. About 28 abdominal scutes, strongly keeled and with a very prominent spine, 10 of which are postventral. Silvery, dark above. Scapular region with dark venules. Fins hyaline. Length 170 mm.

Nomen indig.: Bangkok (Puger).

Habitat: Java (Batavia!, Surabaya, Puger!); Madura; Bali; Sumatra (Telok betong, Padang, Priaman, Siboga); Nias; Banka; Celebes (Makassar!, Badjoa); Ambon. — Tanna; Philippines; China; Siam and westward to the Red Sea and East Coast of Africa (Beira!).

In sea and brackish water.

9. Engraulis dussumieri C. V.

Engraulis Dussumieri Cuvier & Valenciennes, Hist. Nat. Poiss. XXI. 1848, p. 69.
Engraulis Dussumieri Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 43.
Engraulis dussumieri Kner, Fische Novara Exp. 1865—1867, p. 333.
Engraulis mystax Günther, Cat. Brit. Mus. VII. 1868, p. 397 (nec Bl. Schn.).
? *Engraulis mystax* Klunzinger, Sitzungsber. Akad. Wien, LXXX. 1879, p. 416.
Engraulis Dussumieri Day, Fishes of India 4°. 1878—1888, p. 627.

B. 12—13; D. I. 14—15; A. 34—38; P. 11—12; V. 7; L. l. 40—42; L. tr. 10—11.

Oblong, compressed, dorsal profile about as convex as the ventral. Fronto-rostral profile very convex. Height $3^1/_4$—$3^1/_2$, head $3^2/_3$—$4^1/_5$, eye $3^1/_2$—4, snout conspicuously rounded, prominent, nearly $^3/_4$ of eye. Maxillary dilated at mandibulary joint, tapering behind and reaching nearly to the ventrals. Dorsal much nearer to caudal than to snout, its origin nearer to snout, situated far behind origin of ventrals. Anal 3—$3^1/_3$ in length. Its origin behind end of dorsal. Ventrals about $1^1/_2$ of eye; their origin midway between anal and suboperculum. Pectorals as long as head without snout, reaching ventrals. Caudal deeply incised, about 4 times in length. Small teeth on jaws, vomer, palatines, pterygoids and tongue. Eighteen flattened gillrakers, conspicuously spined at the innerside, more

than twice as long as branchial filaments, a little shorter than eye. Scales thin, rather deciduous, with conspicuous vertical lines partly forming a network on the hinder part of the scale, the border of which is roughened. Abdominal scutes about 25, beginning at the throat, 10 being postventral. Yellowish silvery, back dark. Sometimes a blackish spot across the nape down to the scapula. Fins hyaline, caudal margined with blackish. Length to 140 mm. (A specimen of Bleeker's collection seen by us).

Habitat: Java (Batavia, Bantam); Borneo (Sarawak [British Mus.]); Singapore. — China; British India; Queensland?

In sea.

10. **Engraulis valenciennesi** (Blkr.).

Engraulis mystax Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1289. (nec Bl. Schn.).
Engraulis mystax Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 43. (nec Bl. Schn.).
Stolephorus (Thrissa) Valenciennesi Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 306.
Engraulis Valenciennesi Bleeker, Atl. Ichth. VI. 1866—1872, p. 133.
Engraulis Hamiltoni Duncker, Mitth. Naturh. Mus. Hamburg XXI. 1904, p. 185. (nec Gray).
Thryssa valenciennesi Fowler, Proc. Acad. Nat. Sci. Philad. 1911, p. 220.

B. 12—13; D. 1. 13—14; A. 38—42; P. 12—13; V. 7; L. l. about 40; L. tr. 12.

Oblong, compressed, dorsal profile much more convex than abdominal profile, which is nearly straight. Rostro-frontal profile convex. Height $3^1/_3$—$3^2/_3$, head 4—$4^1/_3$, eye $3^1/_2$—$3^2/_3$. Snout rounded, prominent, $^3/_4$ of eye. Maxillary dilated above the mandibulary joint, tapering behind, surpassing base of pectorals. Dorsal more than half the length of the head, nearer to caudal than to snout, much higher than long. Origin of dorsal nearer to caudal than to snout. Anal $2^4/_5$—3 in length, its origin a little before end of dorsal. [1]) Ventrals not much longer than eye, in the middle between anal and suboperculum. Pectorals about as long as head without snout, reaching ventrals. Teeth on jaws, vomer, palatines, pterygoids and tongue, those on jaws directed forward; 16—17 spinulated gillrakers, $^3/_4$ of eye. Scales thin, deciduous, with fine vertical lines, 23 abdominal scutes, beginning at the throat, 8 being ventral. Silvery,

1) As also in Bleeker's figure.

back darker. Scapulary region with black venules. Fins hyaline, caudal with a darker margin. Length to 130 mm.

(A specimen of Bleeker's collection seen by us).

Habitat: Java (Batavia, Palabuan Batu!); Sumatra (Telok betong, Benkulen, Padang); Pinang; Singapore; Borneo (Sinkawang).

In sea.

5. **Stolephorus** Lacépède.

(Lacépède. Hist. nat. des Poissons V, 1803, p. 381. — Max Weber & L. F. de Beaufort, Verh. Akademie Amsterdam XVII, 1912, p. 21).

Elongate; scales thin, very deciduous, not more than 7 prominent spined scutes between pectorals and ventrals. Snout prominent. Maxillary may be produced as far as gillopening. Dorsal, generally without small praedorsal spine, situated totally or partly before anal, which is short (16—23 rays) and goes $4^1/_2$—$7^1/_2$ times in length. Upper pectoral ray not produced. Teeth on jaws, vomer, palatines, pterygoids and tongue. Eleven to 13 branchiostegal rays. Caudal peduncle at least twice as long as high at its end. A silvery band along the sides.

Gregarious, planctonic marine fishes of small size, translucent when alive.

Synopsis of the species.

I. Origin of anal behind dorsal.

a. Anal about 6 times in length. Maxillary tapering posteriorly, its end rounded, reaching hindborder of praeoperculum . . . . . *S. heterolobus* p. 44.

b. Anal 7—$7^1/_2$ times in length. Maxillary truncated behind, reaching to mandibulary joint . . . . . *S. zollingeri* p. 44.

II. Origin of anal below dorsal.

a. Seven spiny abdominal scutes between pectorals and ventrals. Maxillary produced to gillopening. Anal 5—$5^1/_3$ in length . . . . . *S. commersonii* p. 45

b. 4—5 spiny abdominal scutes between pectorals and ventrals.

1. Maxillary reaching to frontborder of praeoperculum. Anal $5^2/_3$—6 in length . . . . . *S. indicus* p. 46

2. Maxillary reaching gillopening, anal $4^1/_2$—5 in length . . . . . *S. tri* p. 47.

1. Stolephorus heterolobus Rüpp.

Stolephorus heterolobus Rüppell, Neue Wirbelth., Fische 1835, p. 79.
Engraulis heterolobus Günther, Cat. Brit. Mus. VII. 1868. p. 392.
Stolephorus heterolobus Bleeker, Atl. Ichth. VI. 1866—1872, p. 126.
Engraulis heterolobus Klunzinger, Abh. Zool. Bot. Gesellsch. Wien XXI. 1871, p. 596.
Engraulis heterolobus Klunzinger, Sitzber. Akad. Wien LXXX. 1880, p. 415.
Stolephorus heterolobus Max Weber, Siboga Exp. Fische 1913, p. 6.

B. 12—13; D. 13—14; A. 16—18; P. 13; V. 7; L. l. 35—36; L. tr. 8—9.

Elongate, height 5—5 1/2, head about 4, eye 3 1/2—4. Snout very prominent, shorter than eye. Maxillary dilated at mandibulary joint, tapering posteriorly; the rounded extremity reaches to the hindborder of the praeoperculum. Origin of dorsal nearer to caudal than to end of snout, far behind origin of ventrals. Anal about 6 in length, its origin just behind last dorsal rays. Ventrals much longer than eye, their origin midway between anal and base of pectorals. Pectorals about as long as postocular part of head, far distant from ventrals. Caudal deeply incised, about 5 times in length. Twenty two slender flattened gillrakers with a double series of spines along the innerside, about 3 times longer than the branchial filaments, not much shorter than eye. Scales very deciduous. Five abdominal spiny scutes between pectorals and ventrals. Yellowish with a silvery lateral band. Length about 90 mm.

Habitat: Sumatra (Telokbetong); Java Sea!; Lombok!; Ternate; Ambon. — Red Sea; Australia.

In sea.

2. Stolephorus zollingeri (Blkr.).

Engraulis Zollingeri Bleeker, Journ. Ind. Arch. II. 1849, p. 73.
Engraulis zollingeri Günther, Cat. Brit. Mus. VII. 1868, p. 387.
Stolephorus Zollingeri Bleeker, Atl. Ichth. VI. 1866—1872, p. 127.
Stolephorus Zollingeri Max Weber, Siboga Exp. Fische 1913, p. 6.

B. 12—13; D. 15; A. 16—17; P. 14; V. 7; L. l. 38; L. tr. 8—9?

Elongate. Height 5 1/3—6, head 3 1/3 to more than 4, eye about 3 1/2. Snout prominent, shorter than eye. Maxillary truncated behind, reaching to the mandibulary joint. Origin of dorsal midway between snout and base of caudal. Anal

7—7$^1/_2$ in length, its origin at some distance behind end of dorsal. Ventrals a little longer than eye; their origin midway between anal and the root of the pectorals. Pectorals about as long as postocular part of head, very far from ventrals. Caudal deeply incised, about 5 in length. Twenty five slender flattened gillrakers with a double series of spines along the innerside, about twice as long as branchial filaments, a little shorter than eye. Scales very deciduous, 5 abdominal spiny scutes between pectorals and ventrals. Yellowish with a silvery lateral band. Length over 100 mm.

Habitat: Java (Batavia); Sumatra (Padang); Bali; Celebes (Macassar); Lombok!; Sumbawa; Ambon; Nusa laut!

In sea.

3. Stolephorus commersonii Lac.

Stolephorus commersonnii Lacépède, Hist. Nat. Poiss. V. 1803, p. 382.
Engraulis Brownii Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 41 (ex parte).
Engraulis Brownii Kner, Novara Exp. Fische, 1865—1867, p. 332.
Engraulis commersonianus Günther, Cat. Brit. Mus. VII. 1868, p. 388.
Stolephorus commersonianus Bleeker, Atl. Ichth. VI. 1866—1872, p. 128.
Engraulis Commersonianus Day, Fishes of India 4°. 1878—1888, p. 629.

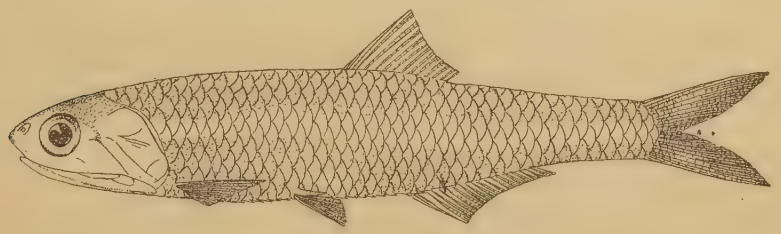

Fig. 19. *Stolephorus commersonii* Lac.

B. 11—13; D. 15—16; A. 20—21; P. 14—15; V. 7; L. l. 38—40; L. tr. 8—9.

Elongate. Height 4$^1/_4$—4$^4/_5$, head about 4, eye 3—3$^2/_3$. Snout bluntly rounded, very prominent, $^3/_4$ of eye. Maxillary moderately broadened at the mandibular joint and continued to the gillopening, where its extremity is pointed. Dorsal midway between point of snout and end of caudal, its origin nearer to base of caudal than to snout, far behind origin of ventrals. Anal 5—5$^1/_3$ in length, nearly as long as head without snout, its origin below the beginning of posterior third of dorsal. Ventrals longer than eye, their origin about

midway between anal and base of pectorals. Pectorals a little longer than postocular part of head, not reaching ventrals. Caudal deeply incised, 4—$4^1/_3$ in length. Nineteen to 20 flattened gillrakers, spinulous along the innerside, more than twice as long as branchial filaments, about $^3/_4$ of eye. Scales very deciduous, thin, with faint vertical lines, rounded behind. Seven abdominal scutes with prominent spines between pectorals and ventrals. Brownish with a silvery lateral band, becoming widest posteriorly. Fins hyaline, caudal powdered with dark. Length 125 mm.

Nom. indig.: Teri, Teri nasi, Teri glaga (Mal. Batavia); Bilis (Bintang); Gnafti (Batjan); Puti (Menado).

Habitat: Java (Batavia!, Semarang!, Bantam, Anjer, Djunkulon, Cheribon, Tegal, Surabaya, Pasuruan, Besuki, Banjuwangi); Madura; Bali; Sumatra (Benkulen, Padang, Tiku, Priaman); Nias!; Singapore; Bintang (Rio); Banka; Borneo (Pamangkat, Balikpapan!); Celebes (Macassar, Bonthain, Badjoa, Manado); Kangeang!; Sangir; Salibabu island (Lirung)!; Ternate; Batjan; Ambon; Schouten Islands (Mysore). — Philippines; westward to British India and seas of Madagascar.

In sea.

4. **Stolephorus indicus** (v. Hass.).

Engraulis indicus van Hasselt, Algem. Konst- en Letterbode 1823, p. 329.
Engraulis balinensis Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Bali, p. 11.
Engraulis Brownii Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1285 (nec Gm.)
Engraulis Russelli Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 38.
Engraulis Russelli Günther, Cat. Brit. Mus. VII. 1868, p. 390.
Stolephorus indicus Bleeker, Atl. Ichth. VI. 1866—1872, p. 127.
Engraulis indicus Day, Fishes of India 4°. 1878—1888, p. 629.
Anchovia indica Jordan & Herre, Proc. U. S. Nat. Mus. XXXI. 1906, p. 638.
Engraulis indicus Günther, Fische der Südsee, Heft VIII. 1909, p. 377.

B. 11—13; D. 16; A. 19—21; P. 14—16; V. 7; L. l. 40; L. tr. 8—9.

Elongate. Height 5—$5^1/_2$, head $3^3/_4$—$4^1/_5$, eye $3^2/_5$—$3^3/_4$. Snout bluntly rounded, very prominent, more than $^3/_4$ of eye. Maxillary broadened above mandibular joint, reaching to frontborder of praeoperculum. Dorsal about midway between end of snout and end of caudal, its origin much nearer to base of caudal than to point of snout, far behind origin of ventrals. Anal $5^2/_3$—6 in length, about as long as head without snout, its origin below the middle of dorsal. Ventrals a little

longer than eye, their origin midway between anal and base of pectorals. Pectorals about as long as postocular part of head, not reaching ventrals. Caudal deeply incised, $4^1/_5$—$4^2/_5$ in length. About 20 slightly flattened gillrakers with a series of fine spinules at the innerside, $^1/_4$ shorter than branchial filaments, a little longer than half eye. Scales thin, very deciduous, smooth, rounded behind. Four to 5 abdominal scutes between pectorals and ventrals. Brownish, with a silvery lateral band, broadest in the middle. A broad dark spot behind occiput. Fins hyaline, caudal powdered with black. Length 145 mm.

Nomen indig.: Teri (Mal. Batavia); Tengadak (Sundan.); Ubeh (Ternate); Puti, Kuruba (Batjan); Puri-puti (Ambon).

Habitat: Java (Batavia, Bantam, Semarang); Madura!; Bali; Lombok!; Bawean; Sumatra (Telokbetong, Padang, Priaman); Nias!; Pinang; Singapore; Bintang (Rio); Banka; Celebes (Macassar!, Tanette! Bonthain, Badjoa, Sindjai, Menado, Tombariri); Batjan; Ternate; Ambon. — Philippines; Formosa; Japan; Samoa; Tahiti; British India.

In sea, ascending tidal rivers.

5. **Stolephorus tri** (Blkr.).

Engraulis tri Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 40.
Engraulis tri Günther, Cat. Brit. Mus. VII. 1868, p. 389.
Stolephorus tri Bleeker, Atl. Ichth. VI. 1866—72, p. 128.
Engraulis tri von Martens, Exp. Ost-Asien, Zoologie I. 1876, p. 404.
Engraulis tri Day, Fishes of India 4°. 1878—1888, p. 630.

B. 11; D. 1. 14—15; A. 20—23; P. 12—13; V. 7; L. l. 32—35; L. tr. 8—9.

Oblong. Height $3^2/_3$—4, head about 4, eye 3—$3^1/_2$. Snout pointed, much projecting, shorter than eye. Maxillary produced to gillopening. Dorsal much nearer to base of caudal than to snout. Its origin far behind origin of ventrals, about midway between snout and caudal. Anal $4^1/_2$—5 in length, as long as head or a little shorter, its origin below last $^1/_4$ of dorsal. Ventrals about midway between suboperculum and anal. Pectorals pointed, scarcely longer than postorbital part of head. Caudal deeply incised, about 4 in length. Scales thin, generally reticulated, very deciduous; 4—5 abdominal spiny scutes between pectorals and ventrals. 21 stout, serrulated gillrakers, somewhat longer than half of eye,

longer than branchial filaments. A silvery lateral band disappearing in formaline. Caudal yellowish with a black margin.

Length 120 mm. (Compared with specimens of Bleeker's collection in the Leyden Museum).

Nom. indig.: Teri (Malay.).

Habitat: Java (Batavia); Sumatra (Bagan Api Api!); Banka; Borneo (Sampit, Sarawak); Batjan. — Philippines, Malay Peninsula, westward to Bombay.

In sea and ascending rivers.

6. Coilia Gray.

(Gray, Zoolog. Miscell. 1831, p. 9).

Compressed, very elongate, terminating in a long tapering tail. Scales rather small, deciduous. Mouth oblique. Maxillary more or less produced [Fig. 10 on p. 16]. Origin of dorsal before origin of anal, which is very long (62—116 rays) and goes $1^1/_2$—$2^1/_4$ times in length. Caudal pointed, united with the anal. Four to 19 upper pectoral rays are free and filamentous and much prolonged. Teeth on jaws, vomer, palatines, pterygoids and tongue. No caninoid teeth.

Synopsis of the species.

I. 4—6 free pectoral rays.
  A. Origin of dorsal in front of ventrals.
    a. Maxillary with unequal alternate teeth, reaching far beyond root of pectorals. 39—43 abdominal scutes. . . . . *C. macrognathus* p. 49.
    b. Maxillary with almost equal teeth, reaching to root of pectorals. 31 abdominal scutes. . . . . *C. lindmani* p. 49.
  B. Origin of dorsal opposite to ventrals.
    a. 6 free pectoral rays . . . . . *C. dussumieri* p. 50.
    b. 4 free pectoral rays . . . . . *C. quadrifilis* p. 51.

II. 11—19 free pectoral rays.
  A. Maxillary not reaching the hindborder of praeoperculum, 19 free pectoral rays . . . . . *C. rebentischi* p. 51.
  B. Maxillary reaching quite or almost to gillopening, 11—14 free pectoral rays.
    a. Belly rounded before ventrals. Eye $5^1/_2$; 11 free pectoral rays. . . . . *C. polyfilis* p. 52.
    b. Belly with 4 scutes before ventrals. Eye $3^1/_2$ to more than 4; 12—14 free pectoral rays. *C. borneensis* p. 52.

1. Coilia macrognathus Blkr.

Coilia macrognathos Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 436.
Coilia macrognathus Günther, Cat. Brit. Mus. VII. 1868, p. 406.
Coilia (Chaetomus) macrognathus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 138.
Coilia macrognathos von Martens, Exped. nach Ost-Asien, Zool. Teil Bd. 1. 1876, p. 201, 404.

B. 10; D. 1 + 14—15; A. 62—73; P. 16—17; V. 7; L. l. 58—62; L. tr. 10—11.

Elongate, compressed. Height about 4, head $4^2/_3$—5, eye 5—$5^1/_2$. Snout prominent, as long as eye. Maxillary produced into a long sword shaped process, extending far beyond the root of the pectorals, with a row of alternant smaller and stronger teeth along the whole of its border. Dorsal more than twice as near to snout as to caudal. Ventrals inserted just behind origin of dorsal, almost twice as near to suboperculum as to anal. Anal 2—$2^1/_4$ in length of body. Pectorals with the 5 of 6 upper rays produced and reaching or surpassing first anal rays. 39—43 keeled and strongly spiniferous abdominal scutes, 12—13 anterior to the ventrals. About 22 gillrakers, with distinct spines at the innerside, not quite 2 times as long as branchial filaments, as long as eye. Silverish, back darker. Fins hyaline, anterior half of dorsal and border of anal and caudal dusky. Length 260 mm. (Compared with typical specimen in the Leyden Museum).

Habitat: Borneo (Pamangkat, Sungiduri, Sinkawang, Matang, Sarawak). — Siam.

In estuaries.

2. Coilia lindmani Blkr.

Coilia Lindmani Bleeker, Act. Soc. Scient. Indo-Neerl. III. 1858. Zesde Bijdr. vischfauna Sumatra, p. 48.
Coilia lindmani Günther, Cat. Brit. Mus. VII. 1868, p. 405.
Coilia (Chaetomus) Lindmani Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 139.

B. 11; D. 1 + 13; A. 76; P. 17; V. 7; L. l. 50.

Oblong, compressed. Height $4^1/_2$, head about 5, eye almost 4. Snout prominent, shorter than eye. Maxillary rather narrow, extending to below the root of the pectorals, with small, almost equal teeth along its border. Dorsal about two times nearer to snout than to base of caudal. Ventrals inserted scarcely behind origin of dorsal. Anal less than twice in length of

body. Six upper rays of pectorals produced, slightly or very much surpassing origin of anal. Thirty one abdominal spineferous scutes, 12 of which are praeventral. Gillrakers about 34, shorter than eye. Silvery, back dark, fins hyaline. Length of single specimen described 176 mm. (Not seen by us).

Habitat: River Mussi, Palembang (Sumatra). — Siam.

3. Coilia dussumieri C. V.

Coilia dussumieri Cuvier & Valenciennes, Hist. Nat. Poissons XXI. 1848, p. 81.
Leptonurus chrysostigma Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Madura, p. 14.
Coilia dussumieri Günther, Cat. Brit. Mus. VII. 1868, p. 403.
Coilia (*Coilia*) *Dussumieri* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 140.
Coilia Dussumieri Day, Fishes of India 4°. 1878—1888, p. 631.

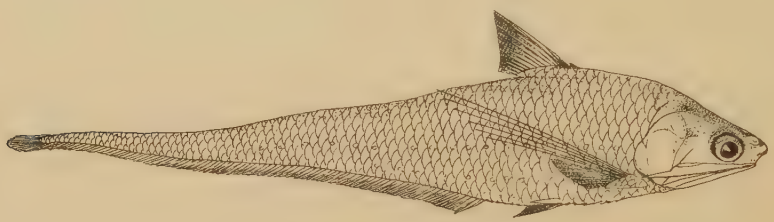

Fig. 20. *Coilia dussumieri* C. V.

B. 9—11; D. I + 14—15; A. 86—110; P. 18; V. 7; L. l. 60—70; L. tr. 10—11.

Elongate, compressed. Height 4—5 1/3, head 5—5 2/3, eye subcutaneous, 3 1/2—4 1/4. Snout prominent, conical, shorter than eye. Maxillary dilated, opposite the mandibular joint, tapering behind and reaching about the hindborder of the suboperculum; with small teeth along the whole of its ventral border. Dorsal more or less than twice as near to snout as to caudal. Length of anal 1 1/2—1 4/5 in length of body. Origin of ventrals opposite to origin of dorsal, about midway between anal and suboperculum, 2—3 in head. Pectorals with the six upper rays filiform and produced to about the middle of the length of the fish. Scales thin, deciduous, with anastomosing lines, 12—14 keeled spiniferous abdominal scutes, 4—6 of which anterior to the ventrals. About 24 gillrakers, with distinct spines at the innerside, three times as long as branchial filaments, nearly

as long as eye. Golden, the lower side with two or three longitudinal rows of shiny spots. Length 160 mm.

Habitat: Java (Surabaya!); Sumatra (Bagan api api!); Madura; Singapore; Banka. — British India.

In sea and estuaries.

4. Coilia quadrifilis Günther.

Coilia reynaldi Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1292 (nec C. V.).
Coilia quadrifilis Günther, Cat. Brit. Mus. VII. 1868, p. 403.
Coilia quadrifilis Steindachner, Sitzber. Akad. Wien, I.X. Abth. II. 1869, p. 571.
Coilia (Coilia) quadrifilis Bleeker, Atl. Ichth. VI. livr. 27. 1875, p. 141.
Coilia quadrifilis von Martens, Exp. Ost-Asien, Zool. Teil, Bd. I. 1876, p. 312.

B. 10; D. I + 15; A. 107—116; P. 15.

Height $5^1/_2$—$5^2/_3$ in total length. Head 6 in length without caudal, $6^1/_2$ in total length. Eye 4. Maxillary obliquely truncated behind, extending to the mandibulary joint. Dorsal more than three times nearer to snout than to tip of caudal. The first divided ray terminates in a filament, which is frequently broken in preserved specimens. The ventrals are situated opposite to the origin of the dorsal. Pectorals with the four upper rays produced, reaching farther than origin of anal. Anal $1^3/_4$ in the total length. Abdomen serrated in front of the ventrals. Pale golden, head and back above dotted with black. One or two series of distant rounded spots of shining gold along the lower half of the body. Fins reddish yellow, upper half of dorsal sparingly dotted with black, caudal and margin of the anal blackish. Length 175 mm. (Not seen by us).

Habitat: Borneo (Sinkawang); Pinang; Singapore. — Malay Peninsula.

In sea and estuaries.

Remark: It is possible that Day (Ind. fishes 4°. p. 632) is right, when he considers *C. quadrifilis* Gthr. to be a variety of *C. dussumieri* C. V. having only 4 free filaments to the pectoral fin.

5. Coilia rebentischi Blkr.

Coilia Rebentischi Bleeker, Act. Soc. Scient. Indo-Neerl. V. 1858—1859. Twaalfde bijdr. Ichth. Borneo, p. 5.
Coilia (Coilia) Rebentischi Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 140.

B. 7; D. I + 14; A. 94; P. 28; V. 7; L. l. 65; L. t. 9—10.

Subelongate, compressed. Height $5^1/_2$, head $6^1/_4$, eye about 5. Snout slightly prominent, shorter than eye. Maxillary more or less truncated behind, not reaching hindborder of praeoperculum. Dorsal more than twice as near to snout as to base of caudal. Anal about $1^2/_3$ in length of body. Ventrals inserted slightly in front of origin of dorsal. The 19 upper rays of pectorals produced, far surpassing origin of anal. Abdominal scutes only between (2—3) and behind (9—10) ventrals. Colour yellowish, back, dorsal and anal dusky. Length of single specimen known 125 mm. (Not seen by us).

Habitat: Borneo (Sinkawang).

In estuaries.

6. **Coilia polyfilis** Volz.

Coilia polyfilis Volz, Zool. Anz. XXVI. 1903, p. 559.
Coilia polyfilis Volz, Zool. Jahrb. Abt. Syst. XIX. Heft 4, 1903, p. 408.

D. 13; A. 86; L. lat.?

Height and head 5. Eye $5^1/_2$. Maxillary broadens posteriorly, its greatest depth between the penultimate and last $^1/_5$, tapering rapidly behind that point. Its end reaches exactly to the gillopening. Distance between origin of dorsal and snout 4 times in the total length. Eleven rays of pectorals free, reaching to first ray of anal. Belly rounded before ventrals, sharp behind; 28 gillrakers, as long as diameter of eye. Length of only specimen known 100 mm. (After Volz; not seen by us).

Habitat: Sumatra (Banju asin).

7. **Coilia borneensis** Blkr.

Coilia borneënsis Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 60.
Coilia borneensis Günther, Cat. Brit. Mus. VII. 1868, p. 403.
Coilia (*Coilia*) *borneënsis* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 139.
? *Coilia borneensis* Day, Fishes of India 4°. 1878—1888, p. 632.
? *Coilia borneensis* Vinciguerra, Ann. Mus. Civ. Genova (2) IX. 1890, p. 352.

B. 9—10; D. 1 + 13—14; A. 82—87; P. 18—22; V. 7; L. l. 58—60; L. tr. 10—11.

Oblong, compressed. Height more than 4 to 5, head $4^2/_3$—5, eye $3^1/_2$ to more than 4. Snout prominent, shorter than eye. Maxillary produced almost to the gillopening. Dorsal about

twice as near to snout as to base of caudal. Ventrals inserted in front of origin of dorsal. Twelve to 14 upper rays of pectorals produced, reaching first rays of anal or much farther. Anal $1^2/_3$—$1^3/_5$ in length of body. 11 abdominal keeled spinous scutes, 4 praeventral ones, none of which before pectorals. About 26—28 gillrakers, as long as the eye. Length 140 mm. (Compared with typical specimens of Bleeker in the Leyden Museum).

Habitat: Sumatra (Palembang); Borneo (Banjermasin, Pamangkat, Matang, Sadong). — Siam.

In rivers and estuaries.

5. Subfam. Clupeinae.

Oblong or elongate, more or less compressed. Scales large or moderate, generally very deciduous, often more or less pectinated. Belly sharp or rounded, always with keeled abdominal scutes, with or without prominent spines. Mouth rather large, terminal or superior, snout never prominent. Mouth bordered by the intermaxillary and principally by the maxillaries which have two supplemental bones. Teeth mostly small, often feeble or wanting, variously arranged. Adipose eyelid present or absent. Dorsal in the middle of the back or somewhat posterior or wanting. Anal usually rather long. Ventrals moderately small or wanting. Gillmembranes separate, free from isthmus. Branchiostegals 6—15. Gillrakers slender. Pseudobranchiae present.

Synopsis of the genera.

I. Anal fin moderate, with 15—25 rays. Ventrals well developed. Jaws equal (*Clupeini* Blkr., *Clupeinae* Jordan & Evermann).
   - *A.* Two anal fins, the second one formed by two thickened rays. . . . . *Corica* p. 54.
   - *B.* One continuous anal fin.
     1. Origin of dorsal behind origin of ventrals. Vomerine teeth present . . . . . *Clupeoides* p. 56.
     2. Origin of dorsal before origin of ventrals. No teeth on vomer. . . . . *Clupea* p. 60.

II. Anal fin very long, with more than 30 rays. Ventrals small or absent. Lower jaw prominent (*Pristigastrini* Blkr., *Pristigasterinae* Jordan & Evermann).

A. Dorsal fin present. . . . . *Pellona* p. 84.
B. Dorsal fin wanting.
1. Ventrals present . . . . . *Opisthopterus* p. 95.
2. Ventrals wanting. . . . . *Raconda* p. 97.

1. Corica Hamilton, Buchanan.

(Hamilton, Buchanan. Fishes of the Ganges 1822. p. 253, 383).

Elongate or subelongate, belly not much compressed. Back rounded. Scales moderate, thin, smooth or nearly so. Teeth on jaws, palatines and tongue. Two anal fins, the second formed by two thickened rays, cleft to the base and much longer than the last rays of first anal. Origin of ventrals below that of dorsal. Branchiostegal rays 6. Gillrakers not numerous.

Synopsis of the subgenera.

A. Mouth ordinary. Twenty two slender elongate gillrakers. Teeth very minute . . . . . subgenus: *Corica* p. 54.
B. Intermaxillary prominent and forming a blunt angle with the rather convex, ascending maxillary, beyond the margin of which protrude the points of the rather long teeth. Nineteen thick, short gillrakers. . . subgenus: *Clupeichthys* p. 55.

Subgenus: Corica Ham. Buch.

1. Corica (Corica) pseudopterus (Blkr.).

Spratella pseudopterus Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 432.
Clupeoides pseudopterus Günther, Cat. Brit. Mus. VII. 1868, p. 452.
Corica pseudopterus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 98.
Clupeoides pseudopterus Vaillant, Nouv. Arch. Mus. Hist. Nat. (3) V. 1894, p. 100.

B. 6; D. 15—16; (13—14 Günther, Vaillant); A. 14—16+2; P. 12—13; V. 8; L. l. 37—40; L. tr. 9—10.

Subelongate, compressed. Ventral and dorsal profile almost evenly convex. Height about $4^1/_2$, about $5^1/_2$ with caudal, head about $4^1/_4$, $5^1/_4$—$5^1/_3$ with caudal. Eye about $2^1/_4$—3, nearly equal to or a little longer than snout and about equal to postorbital part of head. Two or one hardly conspicuous small ridges on each side of vertex. Maxillary reaching somewhat beyond frontmargin of eye, somewhat more than twice in head. Origin of dorsal a little nearer to root of caudal than to snout. First anal about equal to half length of head, second anal remote from first. Pectorals about as long as head without snout. Origin of ventrals hardly in front of that of dorsal. Minute

teeth on jaws, palatines and tongue. Scales smooth. Eighteen distinct abdominal spines, six being postventral. Silvery, back dark, fins hyaline. Twenty two slender gillrakers, conspicuously longer than branchial filaments and pupil. Length 51 mm.

(Types of Bleeker in bad state; compared in British and in Leyden Museum).

Habitat: Borneo (Pamangkat, Kapuas, Knapei).

Subgenus: **Clupeichthys** Blkr.

2. Corica (Clupeichthys) goniognathus (Blkr.).

Clupeichthys goniognathus Bleeker, Nat. Tijdschr. Ned. Ind. IX. 1855, p. 275.
Clupeichthys goniognathus Günther, Cat. Brit. Mus. VII. 1868, p. 453.
Corica goniognathus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 97.
Clupeichthys goniognathus Vaillant, Notes Leyden Mus. XXIV. 1902, p. 31.

Fig. 21. *Corica goniognathus* (Blkr.).
i Intermaxillary, *m* Maxillary, 1, 2 supplemental bones; stipped line a shows the border of the infraorbital.

B. 6; D. 15—16; A. 16—17+2; P. 11—13; V. 8; L. l. 39—40; L. tr. 10.

Elongate, ventral profile more convex than the dorsal, which is very little curved. Height 4, nearly 5 with caudal, head 4—4$^1/_2$, 5—5$^1/_2$ with caudal. Eye about 3$^1/_2$ in head, as long as snout, about $^1/_4$ smaller than length of postorbital part of head. Interorbital space convex, smaller than eye. No postfrontal striae. Maxillary narrow, 2$^2/_5$ in head, reaching frontmargin of pupil. Its lower border convex, with submarginal, rather long teeth, only the points of which are prominent beyond that margin. It forms a blunt angle with the horizontally prominent intermaxillary which forms with its counterpart a rounded upper

border with a small median incisure. The thick symphysial part of the mandible does not surpass the point of the snout. Operculum a little broader than half its height, its hindmargin rounded. Lower border of suboperculum convex. Praeoperculum large, its posterior angle rounded. The distance between the origin of the dorsal and the caudal is one eye diameter longer than its distance from the snout. Base of dorsal as long as its height; longer than head without snout. The distance from the base of first ray of first anal to base of last ray of second anal about as long as dorsal. Base of first anal as long as head without snout. The distance of the two anals equals length of second anal or $^1/_3$ of eye. Pectorals as long as head without snout, situated low down. Origin of ventrals below origin of dorsal. Maxillary with small teeth, intermaxillary with distinct curved teeth, similar but larger ones in a series in the mandible. Small teeth on vomer, palatines, pterygoids and tongue. Nineteen thick, finely serrulated gillrakers, shorter than branchial filaments, somewhat shorter than pupil. Scales thin, smooth, their hindmargin rounded and entire. Ten flattish scutes with a long keel between pectorals and ventrals, 8 postventral sharper and more prominent scutes. Yellowish, point and top of head and back with dark stips. Opercles silvery, fins hyaline, caudal powdered with black, its margin blackish. Length nearly 90 mm.

Nomen indig.: Bilis (Djambi).

Habitat: Rivers of East Sumatra!; Borneo: River Kapuas and its tributaries!.

2. **Clupeoides** Bleeker.

(Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 274).

Oblong, compressed, abdominal profile generally much more convex than dorsal, scales firm, thin, ventral scutes prominent. Origin of ventrals before or below origin of dorsal. One anal fin. Teeth on jaws, palatines, pterygoids and vomer.

Synopsis of the species.

I. Origin of dorsal nearer to snout than to base of caudal. A silvery lateral band. D. 15—16; A. 18.

a. Height $2^2/_3$—3, eye 3, maxillary reaches to below middle of eye. Eleven postventral abdominal scutes . . . . . *C. lile* p. 57.

b. Height $2^2/_5$—$3^3/_5$, eye $3^1/_2$, maxillary scarcely reaching to below frontmargin of eye, 8 postventral abdominal scutes . . . . . *C. venulosus* p. 58.

II. Origin of dorsal midway between snout and base of caudal. Maxillary reaches to below middle of eye.

a. Height less than 4. Head $3^1/_2$—$3^3/_4$. L. l. 35—37. *C. hypselosoma* p. 59.

b. Height 4 or more than 4, head 4—$4^2/_5$. L. l. 39—42.

α. Eighteen abdominal scutes, 9 being postventral, no silvery lateral band. D. 15—16; A. 16—18. Caudal with black margin . . . . . *C. borneensis* p. 60.

β. Seventeen abdominal scutes, 7 being postventral. A silvery lateral band. D. 12—14; A. 21. Tip of the upper caudal lobe blackish. . . . . *C. papuensis* p. 60.

1. Clupeoides lile (C. V.).

Meletta lile Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 378.
Alausa champil Cantor, Journ. Asiatic Soc. Bengal XVIII. 1850. p. 1284, (nec Gray).
Rogenia argyrotaenia Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 26. — Nat. Tijdschr. Ned. Ind. III. 1852, p. 457.
Rogenia argyrotaenia Kner, Fische Novara Exp. 1865—67, p. 328.
Clupea argyrotaenia Günther, Cat. Brit. Mus. VII. 1868, p. 423.
Clupea (*Clupeoides*) *argyrotaenia* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872. p. 101.
Clupea lile Day, Fishes of India 4°. 1878—88, p. 638.

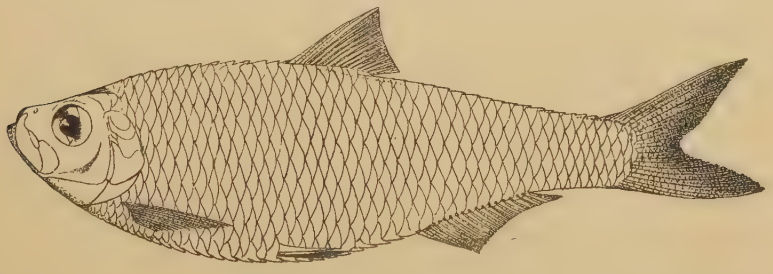

Fig. 22. *Clupeoides lile* (C. V.)

B. 6; D. 15—16; A. 17—19; P. 13—14; V. 8; L. l. 38—41; L. tr. 10—11.

Oblong, very compressed, lower profile strongly convex, upper profile very little curved, front of head concave. Back serrated between head and first dorsal. Height $2^2/_3$—3, $3^1/_3$—4 with caudal, head 4—$4^1/_4$, 5—$5^1/_2$ with caudal, eye 3—$3^1/_4$ with large adipose eyelids, longer than snout, about equal to postorbital part of head. Several diverging postfrontal striae. Maxillary reaches to front part of pupil, $2^1/_3$ in head. Operculum about two times as high as broad, suboperculum pointed

behind, with a convex lower border. Praeoperculum with rounded posterior angle. Origin of dorsal nearer to snout than to caudal, its height about as long as its base and about equal to head without snout, and a little shorter than base of anal. Pectorals a little longer than head without snout. Origin of ventrals before origin of dorsal. Teeth on vomer, palatines, pterygoids and tongue. Gillrakers about 32, somewhat longer than the branchial filaments, shorter than half eye. Nineteen praeventral, 10 more prominent postventral abdominal sharp-edged scutes. About 16 dorsal edged scutes. Scales firm, smooth, border rounded and irregularly crenulated. Yellowish; head, abdomen and a median lateral band silvery. Two rows of black dots along the back. Black dots on point of snout, top of head and in a row along each side of the base of the anal. Caudal dotted with black,, the dots more crowded at the margin. Length about 90 mm.

Nomen indig.: Tembang, Kalapan (Malay. Batavia).

Habitat: Java (Batavia! Samarang! Japara, Bantam); Pinang; Singapore; Banka. — Siam; Burma; Ceylon; West coast of India.

In see, along the coast.

2. **Clupeoides venulosus** M. Web. & de Bfrt.

Clupeoides venuloses Max Weber & L. F. de Beaufort, Verhand. Akademie Amsterdam XVII, N⁰. 3. 1912, p. 3.

B. 6; D. 14; A. 18; P. 13; V. 8; L.l. 38—40; L. tr. 12.

Elongate, compressed, dorsal profile convex from snout to dorsal, ventral profile more convex from snout to anal. Height about $3^1/_2$, $4—4^1/_3$ with C., head $4^1/_5—4^7/_{10}$, $5^2/_5—5^1/_2$ with C. Eye about $3^1/_2$, situated in the anterior half of head, a little longer than snout. Interorbital space a little less than diameter of eye, very convex. A blunt median keel along the head. Occipital part of the head and scales on the neck rugose. Maxillary reaches to frontborder of eye or not so far, nearly 4 times in head, falciform, with a broad supplemental bone. Anteriorly it joins the intermaxillary, which forms the front-margin of the mouth. Mandibles prominent. Operculum twice as high as broad, with a deep transverse furrow in its posterior third, its hindborder nearly rounded, its lower border oblique; subopercultum about twice as long as broad, its lower border rounded. Praeoperculum with vertical hindborder and rounded angle. Cheeks and opercles venulated. Distance of origin of

dorsal to caudal one diameter of eye longer than its distance from point of snout. Its base shorter than its height, which equals head without snout. Pectorals as long as head without snout, ventrals nearly $^1/_5$ shorter. Their origin $^2/_3$ eye diameter before origin of dorsal. Base of anal nearly as long as head. Its longest ray about as long as postorbital part of head. Caudal deeply forked, innerside of its lobes convex. Lower jaw with a series of fine curved teeth. Intermaxillary with very fine teeth. Teeth on tongue, and minute ones on the vomer, not perceptible on palatines. Gillrakers 17, coarse, much shorter than filaments, distinctly shorter than pupil. Pseudobranchiae present. Surface of scales with reticulated lines, those on the flanks also striated. Serration on abdomen more perceptible to touch than visible, sharper in young specimens. Between pectorals and ventrals 12—14 scutes, postventral about 8, which are a little stronger. Yellowish brown on the back, otherwise more silvery, with a broad metallic blue lateral band. Fins hyaline. Caudal with exception of its hindborder, dark powdered. Length up to 120 mm.

Habitat: Lorentz-river, Dutch South New Guinea.

In freshwater.

3. Clupeoides hypselosoma Blkr.

Clupeoides hypselosoma Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 293.
Clupeoides hypselosoma Günther, Cat. Brit. Mus. VII. 1868, p. 451.
Clupea (*Clupeoides*) *potamophilus* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 101.

B. 6; D. 15; A. 16; P. 13; V. 8; L. l. 35—37; L. tr. 9—10.

Oblong, compressed, ventral and dorsal profile subequal. Height a little more than 3, about 4 with caudal, head about $3^3/_4$, about $4^3/_4$ with caudal. Eye about 3, longer than snout. Two or 3 indistinct postfrontal striae. Maxillary reaches beyond frontmargin of eye, $2^1/_2$ in head. Origin of dorsal fin midway between the end of the snout and the root of the caudal. Pectorals a little shorter than head without snout. Origin of ventrals opposite to origin of dorsal. Very small teeth on jaws, vomer, palatines and pterygoids. Scales not or almost not striated, hindmargin smooth. Eleven abdominal scutes, 7 of which are postventral and have slender curved spines. More or less silvery, back darker. No silvery lateral band. Fins hyaline. Length of single specimen known (British Museum): 57 mm. [Not seen by us].

Habitat: Borneo (Banjermassin), freshwater.

4. Clupeoides borneensis Blkr.

Clupeoides borneensis Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 275.
Clupeoides borneensis Günther, Cat. Brit. Mus. VII. 1868, p. 452.
Clupea (*Clupeoides*) *borneensis* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 101.

B. 6; D. 15—16; A. 16—18; P. 12—13; V. 8; L. l. 39—42; L. tr. 10—12.

Subelongate, compressed, dorsal and ventral profile subequally convex. Height about 4, about 5 with caudal; head $4—4^1/_3$, $5—5^1/_3$ with C. Eye about 3, longer than snout; 2 very indistinct postfrontal striae. Maxillary reaches to below frontmargin of eye, about $2^1/_2$ in head. Origin of dorsal fin midway between the end of the snout and the root of the caudal. Pectorals not shorter than head without snout. Ventrals opposite to dorsal or nearly so. Minute teeth on jaws, vomer, palatines and pterygoids. Scales generally smooth. Eighteen conspicuous abdominal spines, nine being postventral. Silvery, back dark. No silvery band along side. Fins hyaline, caudal with a black margin behind. Length to 80 mm. [Not seen by us].

Habitat: Borneo (Banjermassin), fresh water.

5. Clupeoides papuensis (Ramsay & Ogilby).

Corica papuensis Ramsay & Douglas Ogilby, Proc. Linn. Soc. N. S. Wales ser. 2. I. 1886, p. 19.

D. 12—14; A. 21; P. 11; V. 8; L. l. 40; L. tr. 10. Vert. 43.

Elongate, compressed. Length of head, of caudal fin and height of body equal and $5^2/_5$ in the total length. Eye $2^5/_6$, double as long as snout. Maxillary reaches fully to the middle of the orbit. The origin of the dorsal exactly midway between the point of the snout and the base of the tail. Anal commences far behind the termination of the dorsal. Base of ventrals rather before dorsal. Caudal forked, the lobes equal. Twelve praeventral and 7 postventral abdominal serrated scales. Silvery, with the occiput and a broad longitudinal band steel blue, tip of the upper caudal lobe blackish. Length of the specimen described about 91 mm. [Not seen by us].

Habitat: Strickland-river, South New Guinea.

3. Clupea L.

(Linné. System. naturae ed. X^a 1758, p. 317. p. p.).

Oblong, compressed. Scales mostly deciduous, thin, ventral scutes with prominent spines or smooth. Origin of ventrals

behind origin of dorsal. One anal fin. Teeth variously arranged on jaws, palatines, pterygoids and tongue, sometimes absent. Vomerine teeth always wanting.

Synopsis of the subgenera.

I. Belly obtuse, not cultrate, postventral edge not serrated. Teeth on palatines, pterygoids and tongue . . Subgenus: *Amblygaster*. p. 61.

II. Belly strongly compressed, cultrate, serrated, teeth variable.

a. Oblong. Intermaxillaries meeting at an acute angle, sometimes forming an incisure for the tip of the lower jaw. Height about 3 or less. Teeth deciduous, if present, only on jaws. . . Subgenus: *Alosa* p. 64.

b. Oblong or suboblong. Border of upper jaw without incisure. Height generally more than 3, if less the dentition is complete (exc. *melanura*). Teeth, if complete, on jaws, palatines, pterygoids and tongue. . . . . Subgenus: *Harengula* p. 68.

1. Subgenus **Amblygaster** Bleeker.

Synopsis of the species.

I. Maxillary reaches to below frontmargin of eye or nearly so, 14—15 postventral abdominal scutes.

a. A pearl-coloured longitudinal band, often with a series of dark spots; 30 gillrakers . . . . . *C.* (*A.*) *leiogaster* p. 61.

b. No lateral band, 40 gillrakers. . . . . *C.* (*A.*) *sirm.* p. 62.

II. Maxillary distinctly distant from frontmargin of eye, 12 postventral abdominal scutes; no lateral band, 28 gillrakers. . . . . *C.* (*A.*) *clupeoides* p. 63.

1. **Clupea (Amblygaster) leiogaster** (C. V.).

Sardinella leiogaster Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 270.
Clupea sirm Günther, Cat. Brit. Mus. VII. 1868, p. 425. (partim).
Clupea (*Amblygaster*) *leiogaster* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 102.
Clupea liogaster Klunzinger, Abh. Zool. Botan. Ges. Wien XXI. 1871, p. 598.

B. 6; D. 17—18; A. 18—20; P. 16—18; V. 8; L. l. 42—44; L. tr. 10—12.

Elongate, dorsal and ventral profile nearly equal, height about $4^1/_2$—$4^2/_3$, head 4—$4^1/_4$, eye $3^1/_3$—$3^1/_2$, a little shorter

than snout, about $^1/_4$ shorter than postorbital part of head. Maxillary reaches frontmargin of eye or nearly so, $2^1/_2$—$2^3/_4$ in head; 10—12 diverging postfrontal striae. Operculum about $2^1/_2$ times as high as broad. Suboperculum small, hindmargin oblique; hindmargin of praeoperculum straight, its angle rounded. Cheeks, opercles and streak above and behind them venulous. Base of dorsal nearer to caudal than to snout. The distance of its origin to the caudal is $^1/_6$ longer than that to the snout. Its base about as long as its height, twice as long as diameter of eye. Base of anal shorter than that of dorsal. Pectorals nearly as long as head without snout. Ventrals below second $^1/_4$ of dorsal. Caudal with the base scaly and with two large elongated scales. Length of caudal $5^1/_2$—6 in the total length. Teeth on palatines, pterygoids and on the tongue. Gillrakers about 30, roughly tuberculated all round, half as long as eye. Scales smooth, deciduous, thin, their hindmargin irregular; about 17 praeventral and 14 postventral flatly carinated scutes. Above dark blue, below silvery, upperhalf of sides with pearl-coloured longitudinal band, sometimes with 12—20 dark blue spots. Scapular region sometimes with dark spot. Fins hyaline; dorsal and caudal dusky. Length over 200 mm.

Habitat: Java (Batavia!); Island Onrust!; Sumatra (Telokbetong); Singapore; Celebes (Bulucomba, Menado); Batjan; Obi major; Ceram (Wahai). — China; Ceylon; Red Sea.

2. Clupea (Amblygaster) sirm Rüpp.

Clupea sirm Rüppell, Neue Wirbelth. Fische, 1835—1840, p. 77 [1]).
Sardinella leiogastroides Bleeker, Nat. Tijdschr. Ned. Indië, VII. 1854, p. 255.
Clupea sirm Günther, Cat. Brit. Mus. VII. 1868, p. 425 (pro parte).
Clupea (*Amblygaster*) *leiogastroides* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 102.
Clupea sirm Günther, Fische der Südsee, Heft VIII. 1909, p. 383.

B. 6; D. 18; A. 17—18; P. 17; V. 8; L. l. 42—45; L. tr. 10—12.

Elongate, dorsal and ventral profile nearly equal. Height $4^1/_2$—$4^3/_4$, head $4^1/_4$—$4^1/_2$, eye $3^1/_2$—$3^2/_3$, a little shorter than snout, $1^1/_2$ in postorbital part of head. Maxillary reaches to frontmargin of eye, about $2^1/_2$ in head. More than 15 diverging postfrontral striae, the innermost of both sides touch each other nearly in the median line. Operculum more than $2^1/_2$ times as high as broad, suboperculum quadrangular, not

1) Forskål; Descr. Animal. 1775, p. XVII: „Clupea charact. harengi; sed minor. Arab. *Sirm* (Not binomial).

much longer than broad. Hindmargin of praeoperculum rounded. Base of dorsal nearer to caudal than to snout. The distance of origin of dorsal to caudal is about $1^1/_6$ of its distance to snout. Base of dorsal shorter than its height, about as long as head without snout, a little longer than anal. Pectorals as long as head without snout. Ventrals below first $^1/_3$ of dorsal. Caudal scaly at base, with two elongated scales, about 6 in total length. Teeth on palatines, pterygoids and tongue. Gill-rakers 40, longer than half diameter of eye, indistinctly spinulous. Scales deciduous, thin, with very fine concentric stripes. 15—16 praeventral, 14—15 postventral flatly carinated scutes. Upper-side dark blue, silvery beneath. Fins hyaline. Caudal and sometimes upperborder of pectorals violet. Length 150 mm.

Habitat: Java (Tandjong Priok!) Celebes; Ternate; Ambon; Singapore. — Philippines; Samoa; Kingsmill islands; Red Sea; Mosambique; Zanzibar.

3. Clupea (Amblygaster) clupeoides (Blkr.).

Amblygaster clupeoides Bleeker, Journ. Ind. Arch. 1849, p. 73.
Clupea clupeoides Günther, Cat. Brit. Mus. VII. 1868, p. 425.
Clupea (*Amblygaster*) *clupeoides* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 103.

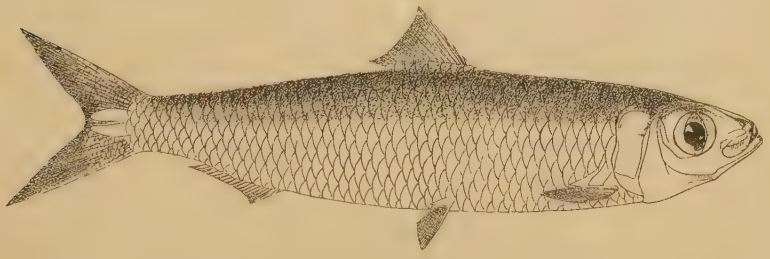

Fig. 23. *Clupea* (*Amblygaster*) *clupeoides* (Blkr.)

B. 6; D. 18—19; A. 17—18; P. 16—17; V. 8; L. l. 40—43; L. tr. 11—12.

Elongate, dorsal and ventral profile nearly equal, height $3^3/_4$—$4^1/_4$, head 4—$^1/_3$, eye $3^1/_3$—$3^3/_4$, about as long as snout, smaller than postorbital part of head. Maxillary does not reach frontmargin of eye, a little more than 3 times in head. About 12 diverging postfrontal striae. Operculum more than $2^1/_2$ times as high as broad, suboperculum rhombic, its lower posterior angle rounded. Hindmargin of praeoperculum indistinctly convex, its angle rounded. Base of dorsal much nearer to caudal than to snout. Its origin distinctly nearer to snout

than to caudal. Dorsal as high as long, its length equalling the length of eye and snout, longer than anal. Pectorals shorter than head without snout. Ventrals below first $^1/_3$ of dorsal. Caudal with the base scaly, and with two elongated scales, about 5 times in total length. Teeth on palatines, pterygoids and tongue. Gillrakers 28, coarse, roughly tuberculated all round, half as long as eye. Scales deciduous, smooth, thin, their hindmargin irregular and very finely striated on part on the scales. About 15—16 praeventral and 12 postventral scutes, with exception of the anterior ones flatly carinated. Above dark blue green, below silvery, no pearl-coloured longitudinal band or series of spots. Fins hyaline, caudal with a brownish margin. Length 270 mm.

Habitat: Java (Batavia!); Sumatra (Telokbetong); Bintang; Celebes (Macassar). — Philippines (Jordan & Seale).

2. Subgenus **Alosa** Cuvier.

I. Caudal longer than head: no striae on head.
   a. Scales striated, crenulated, L. l. 39—41. Gillrakers at least as long as eye. Maxillary exceeds middle of eye. . . . . *C.* (*A.*) *toli* p. 64.
   b. Scales scarcely striated and ciliated, L. l. 44—46. Gillrakers much shorter than eye. Maxillary reaches to pupil . . . . . *C.* (*A.*) *macrura* p. 65.

II. Caudal as long or shorter, than head, postocular part of vertex striated.
   a. Scales nearly smooth, not crenulated, 17 praeventral abdominal scutes. 64 gillrakers. Height $2^1/_3$. . . . . *C.* (*A.*) *platygaster* p. 66. (see also *C.* (*A.*) *brevis*) p. 67.
   b. Scales striated and crenulated, 15 praeventral abdominal scutes. 88 gillrakers. Height $2^1/_2$—3. *C.* (*A.*) *kanagurta* p. 67.

1. Clupea (Alosa) toli C. V.

Clupea sinensis Bloch. Ausländ. Fische IX. p. 38. Tab. 405 (nec? Linné Syst. Nat. ed. XIII. Gmelin p. 1408).
Alausa toli Cuvier & Valenciennes, Hist. Nat. Poiss. XX. 1847, p. 435.
Alausa toli Cantor. Journ. Asiat. Soc. of Bengal XVIII. Cat. Malay. Fishes. 1849, p. 1281. (p. p. fide Day).
Alausa ctenolepis Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 32.
Clupea toli Günther, Cat. Brit. Mus. VII. 1868, p. 447.
Alosa toli Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 113.
Clupea toli Day, Fishes of India 4°. 1878—1888, p. 641.
? *Clupea* (*Alausa*) *sinensis* von Martens, Exp. Ost-Asien, 1876, p. 308 & 405.

B. 6; D. 17—18; A. 18—20; P. 15—16; V. 7—9; L. l. 39—41; L. tr. 14—15.

Oblong, compressed. Height 3—3 1/4; head 3 1/2—4; eye 4 1/2—5 1/2, 2 1/2—3 1/4 in postorbital part of head, about equal to snout. Maxillary exceeds vertical through middle of eye, 2—2 1/4 in length of head. No postfrontal striae. Praeoperculum with an obtuse rounded angle, operculum 1 1/2—1 3/4 higher than broad, suboperculum tapering behind. Origin of dorsal nearer to snout than to caudal; dorsal about as long at its base as its height which is about half the height of the body. Anal equals about the length of the dorsal but it is lower. Pectorals about as long as the head excluding the snout. Ventrals opposite to or a little behind middle of dorsal. Caudal, especially in adult, much longer than the head. Scales adherent, regularly arranged, longitudinally striated and crenulated; 17—18 prae- and 12—13 postventral keeled abdominal scutes. About 65 slender gillrakers at least as long as the eye. Colour silvery, scales of back more or less conspicuously dark coloured, in the young with a dark shoulder-spot. Fins light-coloured, caudal diffusely dark margined. Length about 600 mm.

Nomen indig.: Tĕrubuk padi (Bagan Api Api).

Habitat: Java (Batavia); Sumatra (Telokbetong, Bagan Api Api!); Pinang; Singapore; Banka. — Malay Peninsula; Siam; Formosa; British India.

In sea and aestuaries.

2. Clupea (Alosa) macrura (Blkr.).

Alausa macrurus Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht. p. 31. (secund. fig. et nomen Kuhl & v. Hasselt).
Alausa macrurus Bleeker, Nat. Tijdschr. Ned. Ind. IV. 1853, p. 501.
Clupea macrura Günther, Cat. Brit. Mus. VII. 1868, p. 448.
Alosa macrurus Bleeker, Atl. Ichth. VI. 1872, p. 113.

B. 6; D. 17—18; A. 18—21; P. 15—16; V. 7—8; L. l. 44—46; L. tr. 14—15.

Oblong, compressed, abdominal profile more convex than dorsal one. Height 3; head 4—4 1/2; eye 4 1/3—5, 2 1/2—3 in postocular part of head; equal to snout. Maxillary reaches pupil, goes 3 times in head. No striae on head. Praeoperculum rounded behind; operculum about 2 times as high as broad; suboperculum rounded behind. Origin of dorsal much nearer

to end of snout than to root of caudal. The length of the base of the dorsal about as long as its height, which is less than half the height of the body. The much lower anal about equals the length of the dorsal. Pectorals longer than postocular part of head, ventrals opposite to middle of dorsal. Caudal much longer than head. Scales adherent, regularly arranged, scarcely striated and ciliated; 16—17 prae- and 11—12 postventral keeled abdominal scutes. About 60 fine gillrakers, the longest of which are considerably shorter than the eye. Silvery, back dark. Fins hyaline, caudal dark behind. Length 520 mm.

Habitat: Java (Batavia, Tjiringin, Palabuan); Sumatra (Bagan api api!); Bankalis; Borneo (Sungiduri, Stagen! Sarawak); Singapore. — Known by the malayan name Trubu and Trubuk. It forms the object of a very important fishery at the mouth of some rivers in Borneo, Malacca and Sumatra. The dried and salted fray is known as „telor ikan" in the malayan market. Also in sea.

3. Clupea (Alosa) platygaster Gthr.

Alausa brachysoma Bleeker, Nat. Tijdschr. Ned. Indië, V. 1853. p. 527.
Clupea platygaster Günther, Cat. Brit. Mus. VII. 1868, p. 448.
Alosa brachysoma Bleeker, Atl. Ichth. VI. 1872, p. 115.

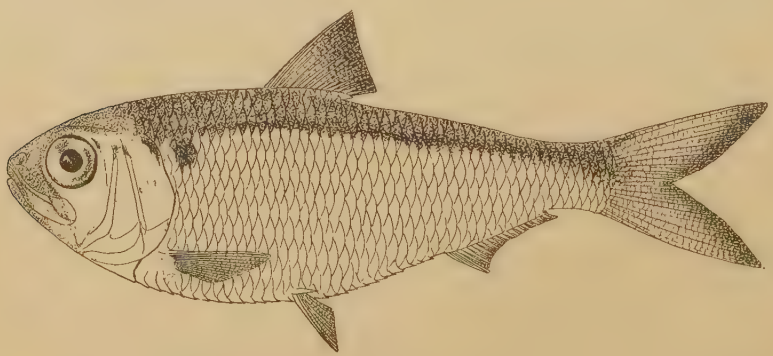

Fig. 24. *Clupea* (*Alosa*) *platygaster* Gthr.

B. 6; D. 17—18; A. 20—21; P. 13—14; V. 8; L. l. 40—43; L. tr. 14—15.

Oblong, abdominal profile much more convex than dorsal one. Height $2^1/_3$, head $3^1/_2$, eye 3, $1^3/_4$ times in postorbital part of head, equal to snout. Maxillary reaches below middle of eye or somewhat farther, 7—10 postfrontal striae. Prae-

operculum obtuse rounded; operculum more than twice as long as high. Lower margin of suboperculum rounded and tapering behind. Origin of dorsal about the length of postorbital part of head nearer to snout than to caudal; the length of dorsal equal to postorbital part; its highest ray about half height of body. Anal as long as dorsal, its highest ray equals the eye. Pectorals shorter than head without snout. Ventrals opposite to middle of dorsal. Caudal about as long as the head. Scales adherent, nearly smooth, not crenulated. Seventeen praeventral and 12 postventral keeled abdominal scutes, the lastnamed are the stronger. About 64 bipinnate gillrakers, about as long as the eye. Colours in alcohol silvery with a golden hue, back dark grey with indication of a dark longitudinal line. Fins hyaline, dorsal darktipped and caudal with a dark margin. A dark patch on the shoulder. Length to about 140 mm.

Habitat: Java (Tjilatjap! Dirk de Vries bay!); Sumatra (Padang).

In sea.

4. Clupea (Alosa) brevis Blkr.

Alosa brevis Bleeker, Journ. Ind. Arch. II. N°. 9. 1848. p. 638. — Atl. Ichth. VI. 1872, p. 116.

B. 6; D. 18; A. 18? P. 17; V. 8.

Height nearly 3 in total length, head 4 in body. Eyes 3. Dorsal and ventral profile both convex, caudal forked. Back dark bluish, sides and belly yellowish silvery. Fins yellow.

Habitat: Sumbawa (Bima) in sea.

Note: Shortly after publishing the first very insufficient description, Bleeker lost the only specimen known. Nothing more is known about this species.

5. Clupea (Alosa) kanagurta (Blkr.).

Alausa ilisha Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 33. (*nec Clupanodon ilisha* H. Buch.).
Alausa kanagurta Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 34.
Alosa malayana Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 294.
Alausa ilisha Kner, Fische Novara-Reise, 1865—1867, p. 331.
Clupea ilisha Günther, Cat. Brit. Mus. VII. 1868, p. 445. (pro parte).
Alosa kanagurta Bleeker, Atl. Ichth. VI. 1872, p. 114.
Alosa malayana Bleeker, Atl. Ichth. VI. 1872, p. 114.
Clupea kanagurta Day, Fishes of India 4°. 1878—1888, p. 640.

B. 6; D. 18—19; A. 20—21; P. 14—15; V. 8; L. l. 40—41; L. tr. 13—14.

Height $2^1/_2$—3, head 3—$3^1/_3$, eye $3^1/_2$—4, $1^2/_3$—2 times in postorbital part of head, equal to snout. The maxillary reaches below the middle of the eye in young specimens, below the hindborder in adult ones. Seven to 10 diverging postfrontal striae. Praeoperculum obtusely rounded behind. Operculum nearly double as high as broad; lower margin of suboperculum rounded and slightly tapering behind. Origin of dorsal about $1^1/_2$ diameter of eye nearer to point of snout than to caudal, about as long as postocular part of head; highest ray of dorsal equal to postocular part of head. Height of anal equals about diameter of eye, its base about as long as that of dorsal. Pectorals about $^3/_5$ of head. Ventrals about opposite to middle of dorsal. Caudal with longer inferior lobe, equalling the head. Scales longitudinally striated and crenulated; 15 praeventral and 12—13 postventral keeled abdominal scutes. Gillrakers about 88, closely set, longest $1^1/_3$ of diameter of eye, very slender, pinnate on both sides. Colours in spirits silvery with darkish grey back. Fins hyaline, dorsal black tipped, caudal with blackish margin. Generally with a black shoulderpatch, when young followed by 3 or 4 similar patches in a row. Length 210 mm.

Note: When young, the eye is relatively larger, and so the maxillary reaches only to the middle of the eye and goes only $1^2/_3$ in the postocular part of the head. Bleeker described this stage as a distinct species (*A. malayana*). [See M. Weber and L. F. de Beaufort. Verhand. Akad. Amsterdam XVII. N°. 3, 1912, p. 17].

Nomen indig.: Mata belo, (Mal.).

Habitat: Java (Batavia!, Bantam, Cheribon, Surabaya, Passaruan); Madura; Sumatra (Padang). — British India; Ceylon; Aden and Zanzibar.

In sea.

3. Subgenus **Harengula**.

Synopsis of the species.

I. L. l. 32. . . . . *C.* (*H.*) *dispilonotus* p. 69.

II. L. l. 40—45.

A. Height less than 3.

a. Scales perforated by small holes, their border crenulated. Eye $3^1/_3$.

Gillrakers 60. About 15 praedorsal scales . . . *C.* (*H.*) *brachysoma* p. 70.

b. Scales without holes, their border scarcely crenulated. Eye $2^3/_4$ Gillrakers about 32. About 12 praedorsal scales . . . . . *C.* (*H.*) *koningsbergeri* p. 72.

B. Height 3—4.

a. L.l. about 40. No teeth on the tongue when adult.

1. Dorsal nearer to caudal than to snout. A few teeth in the jaws only . . . . . *C.* (*H.*) *melanura* p. 72.

2. Dorsal midway between caudal and snout. Teeth on the palatines . . . . . *C.* (*H.*) *bulan* p. 73.

b. L. l. more than 40. Teeth on the tongue.

1. Gillrakers more than 50. Eye 3—4.

α. Dorsal nearer to caudal than to snout. Height 3 . . . . . *C.* (*H.*) *perforata* p. 74.

β. Dorsal midway between caudal and snout. Height $3^1/_4$—$3^3/_4$. . . . . *C.* (*H.*) *fimbriata* p. 75.

2. Gillrakers less than 50. Eye $2^3/_4$–$3^1/_2$.

α. Dorsal midway between caudal and snout.

aa. 13 Postventral scutes.

αα. Height $3^1/_3$—$3^3/_5$. Teeth on palatines . . . . . *C.* (*H.*) *stercolepis* p. 76.

ββ. Height 4. Teeth on tongue only *C.* (*H.*) *venenosa* p. 77.

bb. 15 Postventral abdominal scutes. . . *C.* (*H.*) *thoracata* p. 78.

β. Dorsal nearer to caudal than to snout.

aa. Scales perforated by small holes. Tip of each caudal lobe generally deep black. 18—19 praeventral abdominal scutes. . . . . *C.* (*H.*) *atricauda* p. 80.

bb. Scales not perforated. Tail unicolor, 16—17 praeventral abdominal scutes *C.* (*H.*) *moluccensis* p. 81.

C. Height 4 or more.

a. L. t. 12—13. Eye 4—$4^1/_2$.

1. Height 4. or somewhat more than 4. Teeth on palatines, pterygoids and tongue. A. 13—16 *C.* (*H.*) *longiceps* p. 82.

2. Height 5. No teeth. A. 19 . . . . . *C.* (*H.*) *pinguis* p. 83.

b. L. t. 9—10, eye $3^1/_2$. Height $4^1/_2$—5. Teeth on tongue only. A. 20. . . . . *C.* (*H.*) *schrammi* p. 83.

1. Clupea (Harengula) dispilonotus (Blkr.).

Harengula dispilonotus Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 456.
Clupea dispilonotus Günther, Cat. Brit. Mus. VII. 1868, p. 429.
Clupea (*Harengula*) dispilonotus Bleeker, Atl. Ichth. VI. 1872, p. 112.
Clupea dispilonotus Max Weber, Siboga Exp. Fische 1913, p. 9.

B. 6; D. 18—19; A. 16—18; P. 16—17; V. 8; L.l. 32—36; L. tr. 10—11.

Oblong, compressed, abdominal profile scarcely more convex than the dorsal. Height 3—$3^1/_3$; head 4, a little longer than deep; eye about 3, as long as the postorbital part of the head; snout a little shorter than eye; maxillary reaches anterior margin of pupil, $2^1/_4$—$2^1/_3$ in length of head. Three to 7 longitudinal striae on postfrontal part of head. Operculum about 2 times as high as broad, its lower straight cut margin is oblique; suboperculum rhombic, with rounded inferior posterior angle. Posterior margin of praeoperculum straight, its angle rounded. Cheeks and operculum generally venulous. Dorsal a little nearer to caudal than to snout, its base equals about its height, which is a little more than half height of body. The much lower anal is as long as dorsal. Pectorals $^3/_4$ of head. Ventrals equal to $1^1/_4$ of eye and inserted below first half of dorsal. Caudal $4^1/_4$—$4^1/_2$ in length. Fine teeth on palatines, pterygoids and tongue. Gillrakers about 35, longest half as long as eye. Scales round, with vertical lines, hindmargin very feebly crenulated and finely striated, deciduous; about 15 praeventral and 12—13 postventral conspicuous abdominal scutes. Colour dark on back, otherwise silvery. A dark ocellus behind the middle of base of dorsal, a second one behind dorsal, sometimes a dark patch between both. Origin of dorsal sometimes dark. Fins hyaline but dorsal and caudal often with a dark hue. Length over 80 mm.

Habitat: Singapore; Banka; Bawean; Borneo (Kota Baru!); Kangean!.

In sea and fresh water.

2. Clupea (Harengula) brachysoma (Blkr.).

Sardinella brachysoma Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 19.
Harengula hypselosoma Bleeker, Nat. Tijdschr. Ned. Ind. VIII. 1855, p. 427.
Clupea brachysoma Günther, Cat. Brit. Mus. VII. 1868, p. 423.
Clupea hypselosoma Günther, Cat. Brit. Mus. VII. 1868, p. 431.
Clupea (*Harengula*) *hypselosoma* Bleeker, Atl. Ichth. VI. 1872, p. 104.
Clupea (*Harengula*) *brachysoma* Bleeker, Atl. Ichth. VI. 1872, p. 104.
Clupea brachysoma Day, Fishes of India 4°. 1878—1888, p. 635.
Clupea (*Harengula*) *brachysoma* Weber & de Beaufort, Verh. Akad. Amsterdam, XVII, N°. 3. 1912, p. 13.

B. 6; D. 17—20; A. 18—22; P. 14—16; V. 8; L. l. 44—45; L. tr. 11—13.

Abdominal profile nearly equal to dorsal or conspicuously more convex. Height $2^1/_2$—$2^3/_4$; head 4—$4^1/_4$, nearly as deep as long; eye 3—$3^1/_3$, shorter than postorbital part of head, not much longer than snout. Maxillary reaches to middle of eye or not so far, 2—$2^1/_2$ in head, 4—9 striae on postfrontal part of head. Operculum rather more than twice as high as wide, its lower straight-cut margin is oblique. Suboperculum rhombic, its inferior posterior angle rounded; posterior margin of praeoperculum straight, its angle rounded. Dorsal a little

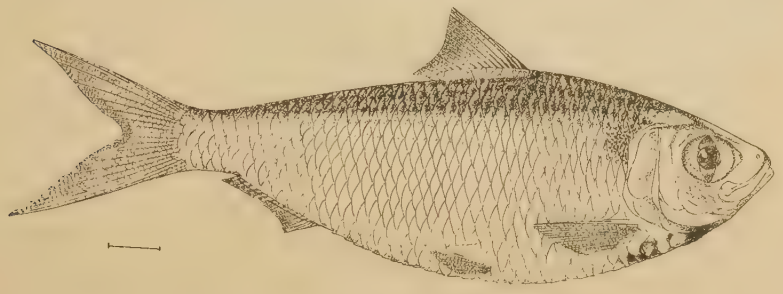

Fig. 25. *Clupea* (*Harengula*) *brachysoma* Blkr.

nearer to base of caudal than to snout, its origin much nearer to snout; its base about as long as its height, which is about two times the height of the body. Anal much lower than dorsal, its base a little shorter than that of dorsal. Ventrals below or a little behind middle of dorsal. Pectorals longer than head without snout. Caudal about $3^1/_2$ in body, scaly. Fine teeth on jaws, palatines, pterygoids and tongue. Gill-rakers about 60, half as long as eye and equal to $^3/_4$ of breadth of operculum. Scales with an irregularly crenulated, incised and striated margin with irregular rows of ovale holes, on peduncle of tail with numerous reticulated and waved ridges; 15 praedorsal median scales; 17 praeventral and 12–13 postventral conspicuous scutes. Colour of back dark, otherwise silvery; a dark spot on base and on top of dorsal, often on tips of caudal and behind the operculum, both disappearing in preserved specimens. Length more than 170 mm.

Nomen indig.: Timbang (Batavia), Tanjan (Sundan.).

Habitat: Java (Batavia!, Tjiringin, Palabuan); Sumatra (Benculen, Padang, Priaman); Banka; Borneo (Baram); Amboina. — Australia; China; British India.

In sea.

3. Clupea (Harengula) koningsbergeri M. Web. & de Bfrt.

Clupea (*Harengula*) *Koningsbergeri* Max Weber & L. F. de Beaufort, Verhand. Akad. Amsterdam, XVII. N°. 3, 1912, p. 14.

B. 6; D. 18—19; A. 20—21; P. 15; V. 8; L. l. 43—44; L. tr. 12.

Abdominal profile conspicuously more convex than the dorsal, which is nearly straight, but oblique from the dorsal to the snout. Height $2^3/_4$; head $3^4/_5$; eye $2^3/_4$, a little longer than postorbital part of head and $^1/_4$ longer than snout. Maxillary reaches nearly to middle of eye, 2 times in head; its inferior border finely denticulated. Three to 5 diverging postfrontal striae. Operculum about three times as high as broad, emarginated behind, its inferior margin straight-cut and oblique, subopercular rhombic, its inferior anterior angle acute, the posterior one rounded; praeoperculum nearly straight behind. Cheeks and operculum venulous. Dorsal about midway between snout and caudal, its origin much nearer to snout. Its base shorter than its height, which is more than half the height of the body. Anal much lower than dorsal, its base about as long as that of dorsal. Ventrals midway the body, they originate not much before middle of dorsal. Pectorals a little shorter than head. Caudal $3^3/_5$ of body, scaly. 4—6 larger curved teeth in mandible, fine teeth on upper jaw, palatines and tongue. Gillrakers 32, longest $^2/_3$ of eye. Scales with 3 vertical lines, their margin entire or more or less crenulated and striated; behind dorsal and on peduncle of caudal with at least 3 waved lines; about 12 praedorsal median scales; 17 praeventral and 12—13 postventral scutes. Back dark, otherwise silvery, on superior half 3 dark longitudinal lines, between the 2 superior about 8 vertical dark patches and sometimes a few on the flanks. Fins hyaline, caudal with a dark hue. Length about 130 mm.

Habitat: Aru Islands!

In sea.

4. Clupea (Harengula) melanura (C. V.).

Alausa melanurus Cuvier & Valenciennes, Hist. Nat. Poiss. XX. 1847. p. 441.

Harengula (*Paralosa*) *Valenciennesi* Bleeker, Verh. Akad. Amsterdam, (2) II. 1868, p. 300, (nomen solum).

Clupea melanura Günther, Cat. Brit. Mus. VII. 1868, p. 449.

Clupea (*Harengula*) *melanurus* Bleeker, Atl. Ichth. VI. 1872. p. 111.

Clupea (*Alausa*) *melanura* von Martens, Exp. Ost-Asien, Zool. Bd. I. 1876, p. 405.
Harengula melanura Sauvage, Poissons Madagascar, 1891, p. 492.
Harengula vanicoris Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 187.

B. 6; D. 15—16; A. 18—19; P. 13—15; V. 8; L. l. 40; L. tr. 10—11.

Oblong, dorsally and ventrally evenly convex or the dorsal profile somewhat more convex. Height 3—$3^3/_4$, head $3^2/_5$—$4^1/_4$, eye 3—$3^1/_2$, somewhat longer than snout, distinctly shorter than postorbital part of head. Maxillary reaches under pupil, but not so far as middle of eye, $2^1/_4$—$2^1/_3$ times in length of head; 3—7 diverging postfrontal striae. Operculum twice as high as broad, subopercular rhombic, lower posterior angle rounded, hindmargin of praeoperculum scarcely emarginated. Dorsal nearer to caudal than to snout. The distance of its origin to the caudal is $1^1/_4$ times its distance from the snout. Length of dorsal less than its height, which is contained $1^3/_4$ times in the height of the body. Anal as long as dorsal. Pectorals nearly as long as head without snout. Ventrals below second $^1/_3$ of dorsal. Caudal $5^1/_2$—$5^2/_3$ in the total length. Teeth almost absent, some scarcely visible on the symphysis of the lower jaw; when young teeth on the tongue. Gillrakers about 38. Scales rounded, with vertical stripes, their margin partly irregularly crenulated; 16 praeventral and 11 postventral abdominal scutes. Brownish above, silvery along the sides and on the under surface. Fins hyaline, caudal tipped with black. Length more than 140 mm.

Nomen indig.: Tandipa (Menado).

Habitat: Java (Palabuan); Sumatra (Benculen); Nias; Bali; Celebes (Menado); Salibabu Island!; Ternate; Ambon; Saparua; Ceram (Wahai); Waigeu; New Guinea.—Philippines; Vanicoro; Siam; Andamans; British India; Madagascar.

In sea.

5. **Clupea** (**Harengula**) **bulan** (Blkr.).

Clupalosa bulan Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Ichth. Mad. p. 12.
Clupea (*Harengula*) *bulan* Bleeker, Atl. Ichth. VI. 1872, p. 111.

B. 6; D. 17—18; A. 19; P. 15; V. 8; L. l. about 40. L. tr. 12—13.

Oblong, compressed, ventral profile more convex than the dorsal. Height 3, head about 4, eye 3. Snout a little shorter than eye. Maxillary reaches not quite below middle of eye, $2^1/_3$—$2^1/_4$

in head. Many diverging postfrontal striae. Dorsal situated midway between caudal and snout, its height about twice in the height of the body. Anal much longer than half head. Pectorals a little shorter than head without snout. Ventrals below middle of dorsal. Caudal about $4^1/_2$ in length. Minute teeth in the lower jaw, none on upper jaw, tongue and pterygoids, small ones on palatines. Scales very deciduous, scarcely or not all transversely striped, 30 very conspicuous abdominal scutes. Dark above, silvery below, fins hyaline. Length 145 mm. [Not seen by us].

Nomen indig.: bulan, lintring (Javan., Madur.).

Habitat: Java (Surabaya); Madura.

In sea.

6. **Clupea** (**Harengula**) **perforata** (Cant.).

Clupeonia perforata Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1276.
Spratella kowala Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 492.
Harengula (*Spratella*) *kowala* Bleeker, Versl. Akad. Amsterdam (2) II. 1868, p. 294.
Clupea perforata Günther, Cat. Brit. Mus. VII. 1868, p. 424.
Clupea (*Harengula*) *perforata* Bleeker, Atl. Ichth. VI. 1872, p. 110.
Sardinella perforata Fowler, Proc. Acad. Nat. Sci. Philad. 1911, p. 206.

B. 6; D. 17—19; A. 18—19; P. 14—15; V. 8; L. l. 43—44; L. tr. 12—13.

Abdominal profile more convex than the dorsal. Height about 3; head 4 to nearly $4^1/_2$; eye 3—$3^1/_2$, a little smaller than postorbital part of head, as long as snout or a little longer. Maxillary reaches to frontmargin of pupil, 2—$2^1/_3$ in head; 8—14 postfrontal diverging striae. Operculum a little more than two times higher than broad, venulous, praeoperculum indistinctly emarginated rounded below, suboperculum oblong quadrangular, lower posterior corner rounded, two times as long as high. Dorsel nearer to caudal than to snout. The distance of its origin to caudal is $1^1/_3$ its distance from the snout. Its base is a little longer than head without its postorbital part. Its height is slightly more than its length. Base of anal longer than base of dorsal. Pectorals $^3/_4$ of head. Ventrals below end of first third of dorsal. Caudal scaly, deeply forked, longer than head, its length $4^1/_2$—$4^3/_4$ in total length. Teeth on palatines and tongue only. Gillrakers 56—58, longest $^3/_5$ eye, half as long as postorbital part of head. Scales adherent, with one

vertical line, their margin striated, irregularly crenulated or identated, with oblong holes; 15—16 praedorsal median scales, 18 praeventral, 13 postventral scutes. Silvery, bluish black above. Sometimes with longitudinal lines on the back. Snout, top of dorsal and a spot at base of its anterior rays blackish. Caudal more or less brown, fins otherwise hyaline. Length to 150 mm.

Nomen indig.: Tembang, tamban (Malay.).

Habitat: Java (Batavia!, Puger!); Sumatra (Padang, Priaman); Pinang; Singapore; Bintang; Banka; Borneo (Balikpapan!, Stagen); Celebes (Macassar!); Amboina; Waigeu. — Philippines; Malacca; Siam; China; South Arabia.

In sea.

7. Clupea (Harengula) fimbriata (C. V.).

Spratella fimbriata Cuvier & Valenciennes, Hist. Nat. Poissons, XX. 1847, p. 359.
Clupea gibbosa Bleeker, Journ. Ind. Arch. III. 1849, p. 72.
? *Kowala lauta* Cantor, Journ. Asiat. Soc. Bengal, XVIII, 1850, p. 1279.
Spratella fimbriata Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 27.
Spratella tembang Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 28.
Spratella tembang Kner, Fische Novara-Exp. 1865—1867, p. 329.
Spratella fimbriata Kner, Fische Novara-Exp. 1865—1867, p. 329.
Clupea tembang Günther, Cat. Brit. Mus. VII. 1868, p. 426.
Clupea fimbriata Günther, Cat. Brit. Mus. VII. 1868, p. 427.
Clupea (*Harengula*) *fimbriata* Bleeker, Atl. Ichth. VI. 1872, p. 105.
Clupea (*Harengula*) *sundaica* Bleeker, Atl. Ichth. VI. 1872, p. 105.
Clupea (*Harengula*) *gibbosa* Bleeker, Atl. Ichth. VI. 1872, p. 106.
Clupea sundaica Macleay, Proc. Linn. Soc. N. S. Wales IV. 1879, p. 373.
Clupea fimbriata Day, Fishes of India 4°. 1878—1888, p. 637.
Harengula sundaica Jordan & Seale, Proc. U. S. Nat. Mus. XXVIII. 1905, p. 770.
Clupea gibbosa Günther, Fische der Südsee, Heft VIII. 1909, p. 381.
Clupea (*Harengula*) *fimbriata* M. Weber & L. F. de Beaufort, Verh. Akademie Amsterdam XVII, N°. 3, 1912, p. 10.

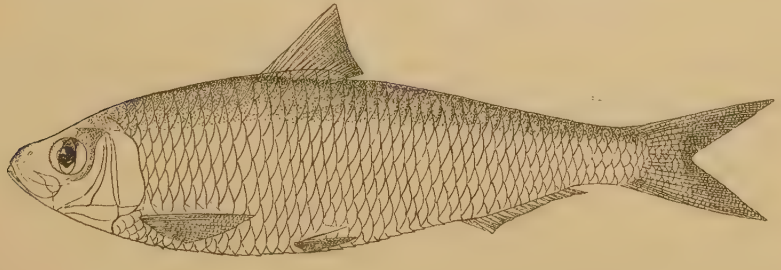

Fig. 26. *Clupea* (*Harengula*) *fimbriata* (C. V.).

B. 6; D. 18—19; A. 16—19; P. 15—16; V. 8; L. l. 45; L. tr. 12.

Abdominal profile a little more convex than dorsal; height $3—3^3/_4$; head $4—4^1/_2$; eye $3—3^3/_4$, $^1/_4—^1/_3$ shorter than postorbital part of head, equals the snout or is a little longer. Maxillary reaches to pupil or not so far, $2^1/_2$ in head; 10—12 postfrontal diverging striae. Operculum $2^1/_2$ times as high as broad, lower margin straight-cut oblique, suboperculum trapezoid, inferior posterior angle rounded. Hindmargin of praeoperculum feebly emarginate, its angle rounded. Dorsal midway between snout and caudal, its origin nearer to snout, its base equals its height. Anal lower than dorsal but equal to its length. Origin of ventrals below the beginning of the second third of dorsal. Pectorals $^3/_4$ of head; caudal more than 4 times in body, scaly. Small teeth on palatines and tongue. Gillrakers 50–52, longest $^3/_5–^3/_4$ of eye, half as long as breadth of operculum. Scales partly with vertical lines the hinderpart with irregular holes (Fig. 27), their margin striated, crenulated, even irregularly dentated; 14—16 praedorsal median scales; 18—19 praeventral, 15 postventral scutes. Back dark-coloured, otherwise silvery, black patch at origin of dorsal, other fins hyaline, marginal part of caudal dusky. Length about 185 mm.

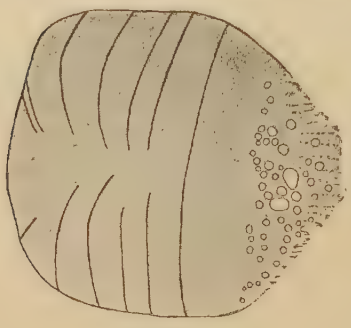

Fig. 27. Scale of *Clupea* (*Harengula*) *fimbriata* × 6.

Nomen indig.: Tembang, tamban, tamban sisig (Malay.); Tanjang (Sundan.).

Habitat: Java (Batavia!, Bantam, Djungkulon, Kragan!, Rembang!, Banjuwangi!); Onrust!; Sumatra (Benkulen, Trussa, Siboga); Nias!; Singapore; Banka; Borneo (Balikpapan!, Kota baru!); Bali; Celebes (Macassar!, Bonthain, Badjoa); Ambon. — Australia, Ponapé, Tonga-Islands, Society-Islands, Fidji-Islands, Marquesas Islands, Philippines, Malacca, China, British India, South Arabia, Zanzibar.

In sea.

8. **Clupea (Harengula) stereolepis** (Ogilby).

Harengula stereolepsis I. D. Ogilby, Proc. Linn. Soc. N. S. W. (2) XXII. 1897, p. 759.

D. 15—17; A. 16; Sc. 45/12.

Dorsal and ventral profiles about equally convex. Depth of body $3^1/_3$ to $3^3/_5$, length of head $3^3/_4$ to 4 in the total length; width of body $2^1/_4$ to $2^1/_3$ in its depth; depth of head $1^1/_5$ to $1^3/_{10}$, width of head $2^1/_9$ to $2^1/_4$, of interorbital region 4 to $4^1/_4$, diameter of eye $2^4/_5$ to 3 in the length of the head; snout $^1/_5$ to $^1/_4$ of a diameter shorter than the eye. Maxillary extending to the vertical from the anterior border of the pupil, its length $2^1/_{10}$ to $2^1/_4$ in that of the head, its width $2^1/_4$ to $2^2/_5$ in its length. 32 or 33 gillrakers on the lower branch of the anterior arch, the longest $1^9/_{10}$ to 2 in the diameter of the eye ($5^1/_3$ to 6 in the head). Dorsal fin originating $^1/_5$ to $^3/_{10}$ nearer to the extremity of the snout than to the base of the caudal fin, its height $^1/_{10}$ to $^1/_5$ more than its length, and $1^2/_5$ to $1^1/_2$ in the head: length of anal slightly less than that of dorsal; ventral inserted below or a little in advance of the middle of the dorsal, and midway between the tip of the mandible and the base of the caudal or a little nearer to the latter, its length 2 to $2^1/_5$ in the head: pectoral with 15 or 16 rays, originating below the angle of the subopercle, $1^1/_3$ to $1^1/_2$ in the head: lower caudal lobe a little the longer, $3^3/_4$ to 4 in the total length. Scales firmly adherent, each with four or five vertical striae and indistinctly pectinated margin; accessory scale of ventral lanceolate, $2^7/_8$ to $3^1/_5$ in the length of the head; abdominal scutes strong, 19 + 13. Upper surface of head rugose; parietal and postfrontal regions striated; opercle smooth. Vertebrae 45.

Back blue, sides golden, the colours passing gradually into one another; upper surface of head gray, the dorsal profile of the snout and the extremity of the jaws reddish-brown: dorsal and caudal with some dark dots; iris golden. Length of the largest example 108 mm.

[After Ogilby, not seen by us].

Habitat: South East New Guinea, Darnley Island, Torres Straits.

9. **Clupea (Harengula) venenosa** (C. V.).

Meletta venenosa Cuvier & Valenciennes, Hist. Nat. Poiss. XX. 1847, p. 377.
Clupea venenosa Günther, Cat. Brit. Mus. VII. 1868, p. 449. — Brenchley's Cruise of the „Curaçoa" 1873, p. 411.
? *Clupea zunasi* von Martens, Exp. Ost-Asien, Zool. Bd. I. 1876, p. 405, (pro parte).
Clupea venenosa A. B. Meyer, Anal. de la Soc. Esp. de Hist. Nat. XIV. 1885, p. 42.
Clupea venenosa Duncker, Mitth. Naturh. Mus. Hamb. XXI. 1904, p. 186.

B. 5; D. 16; A. 17; L. l. 42—44; L. tr. 11.

Height 4, head 4, eye 3, about equal to snout. The maxillary extending to a vertical through frontmargin of the pupil. Operculum twice as high as broad. Hindmargin of the praeoperculum straight. Dorsal about $^3/_4$ of the diameter of the eye, nearer to caudal than to snout, its origin one eye-diameter nearer to snout. Dorsal as high as long, about as long as the anal. Pectorals distinctly longer than the head without snout. Ventrals inserted under the middle of the dorsal fin. Teeth on the tongue, none on the palate. 32 Gillrakers, about as long as branchial filaments, equal to pupil. Scales with some vertical striae, their margin irregularly crenulated; 16—17 praeventral scutes, 13 postventral ones. Silvery, back dark. Dorsal with a black spot on top of first ray. [Not seen by us].

Habitat: Singapore; Batjan; Misol; New Guinea. — Indian Ocean, Seychelles, South Arabia, Red Sea, Seas round Madagascar.

Note: For *Clupea venenosa* Steindachner, Abhandl. Senckenberg. Naturf. Ges. XXV, 1901, p. 456, see under *Clupea schrammi* p. 83.

10. Clupea (Harengula) thoracata (C. V.).

Kowala thoracata Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 363.
Kowala thoracata Cantor, Journ. Asiat. Soc. of Bengal, XVIII. 1850, p. 1278.
Clupea (*Harengula*) *kowal* Bleeker, Atl. Ichth. VI. 1872, p. 109, (nec. Rüppell).

D. 19; C. $19^6/_6$, A. 21 or 22, V. 8; P. 15; Br. VI.

Head above and back deep blue with green reflections; upper third of the sides silvery sea-green; rest of the body, cheeks and opercles shining silvery with mother-of-pearl reflections; upper part of the opercle pale bluish dotted with black; dorsal and caudal pale yellow greenish, sparingly dotted with black, particularly towards the margin; in some individuals a vertical elongated blackish spot at the root of the five central rays; rest of the fins white. Tongue and inside of the mouth minutely dotted with black. Iris silvery, orbital margin black.

The length of the head is $^1/_4$ of the body, $^1/_5$ of the total length. The horizontal diameter of the eye slightly exceeds

$^1/_3$ of the length of the head; the distance across the forehead is $^2/_3$ of the diameter. The eye is covered by a thick adipose duplicature with a vertically elliptic aperture over the circular pupil; it occupies the middle of the distance between the muzzle and the posterior margin of the opercle, and borders on the profile. The figure of Russell represents the eye much too small, probably owing to the adipose fold having been overlooked. On the surface of each of the posterior frontal bones appear upwards of 11 backwards radiating lines. In the individuals examined at Pinang there appeared from six to eight teeth in the lower jaw, and some on the palatal and pterygoid bones, but none in the upper maxillaries, intermaxillaries, nor on the vomer. These teeth are so minute that they require to be seen through a lens in dried specimens, and they are so very deciduous that their number and position vary not only individually, but from side to side. The scales of the body are large, rounded, very thin and deciduous; those of the back and upper third of the sides have each upwards of 16 longitudinal striae. The sides are covered by 11 longitudinal series of scales, of which there appear to be upwards of 45 in the longest series. There are 35 spines on the abdominal profile, the scales of which resemble in breadth those of the species of Pellona. The greatest vertical diameter of the body, in front of the dorsal, is a little less than $^1/_4$ of the total length. The dorsal occupies the middle of the distance between the muzzle and the root of the caudal; the fourth ray, the longest, equals the extent of the base, which is $^1/_2$ of the greatest vertical diameter of the body. The fin is half covered by an oblique backwards rising series of scales which almost hide the last rays. The caudal is deeply cleft, the lobes exceed by $^1/_6$ the length of the head. The scaly anal rays are very short; the last slightly elongated; the extent of the base is $^2/_3$ of the length of the head; its distance from the root of the caudal is $^1/_2$ of the extent. The ventrals are situated opposite the centre of the dorsal exactly in the middle between the root of the first pectoral and anal rays; their length is $^1/_3$ of the head. The length of the pectorals is $^2/_3$ of the head. At Pinang single individuals are of rare occurence. Length: 140 mm.

[After Cantor; not seen by us].

Habitat: Pinang; Pondicherry.

11. Clupea (Harengula) atricauda Gthr.

? *Clupeonia Commersonii* Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 350 [1]).
Harengula melanurus Bleeker, Nat. Tijdschr. Ned. Ind. V. 1853, p. 245, (nec Cuvier & Valenciennes).
Clupea atricauda Günther, Cat. Brit. Mus. VII. 1868, p. 426.
Clupea (*Harengula*) *atricauda* Bleeker, Atl. Ichth. VI. 1872, p. 106.
Clupea atricauda Day, Fishes of India 4°. 1878—1888, p. 636.
? *Clupeonia Commersonii* Sauvage, Poissons Madagascar 1891, p. 494. (Syn. p. p.).
Harengula commersoni Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 186.
Clupea atricauda Günther, Fische d. Südsee VIII. 1909, p. 381.

B. 6; D. 17—18; A. 15—17; P. 15—16; V. 8; L. l. circa 45; L. tr. 12—13.

Oblong, dorsally and ventrally evenly convex. Height about 4, head about 4, eye $3^1/_3$—$3^3/_4$, shorter than snout. Maxillary reaches behind first third of pupil. About 7 diverging postfrontal striae. Operculum 2 times as high as broad, subopercular square, posterior inferior corner rounded, 2 times as broad as high. Lower corner of praeoperculum rounded. Venules on cheeks, operculum and above and behind it. Dorsal nearer to caudal than to snout, its origin about the length of the postorbital part of head nearer to snout than to caudal. Length of anal and dorsal both about as long as snout and eye. Pectorals $^2/_3$ of head. Ventrals a little longer than postorbital part of head, their origin nearer to anal than to head. Caudal deeply forked, its base scaled, $4^3/_4$—5 in the total length. Teeth on pterygoids and palatines. Narrow stripe of teeth on tongue posteriorly. Gillrakers 40, longest $^3/_5$ of eye, $^1/_5$ shorter than postorbital part of head. Scales with concentric lines, their margin striated, finely irregularly crenulated and with very small round holes. 18—19 praeventral, 13 postventral scutes. Silvery, dark above, on the back indications of darker bands along the rows of scales. Fins hyaline, dorsal and caudal dusky, tips of caudal deep black. Length to about 160 mm.

Nomen indig.: Lenguru (Puger); Bik-hokkoa, Ekor angus (Batjan). Oormetting (Saparua); Biki-hoko (Ternate); Armattin (Ambon).

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1) Probably the same species, but it has after Valenciennes and Sauvage no teeth on palatines and according to the former 13, according to the latter 16 dorsal rays.

Habitat: Java (Batavia! Puger!); Nias; Bali; Celebes (Menado!, Tombariri); Sangir Islands; Ternate; Batjan; Obi; Ambon; Saparua; Ceram (Wahai, Kawa!, Kairatu!); Halmahera. — Samoa Islands, Society Islands, Harvey Islands. Westward to Andamans. Madagascar?

12. Clupea (Harengula) moluccensis (Blkr.)

Harengula moluccensis Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 609.
Harengula Kunzei Bleeker, Nat. Tijdschr. Ned. Indië XII. 1856—1857, p. 209.
Clupea moluccensis Günther, Cat. Brit. Mus. VII. 1868, p. 427.
Clupea (*Harengula*) *moluccensis* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 107.
Clupea (*Harengula*) *Kunzei* Bleeker, Atl. Ichth. VI. 1866—1872, p. 107.
Clupea Klunzei Day, Fishes of India 4°. 1878—1888, p. 636.
Harengula moluccensis Jordan & Richardson, Bull. Bur. Fish. XXVII. 1908. p. 236.
Clupea Kunzii Günther, Fische der Südsee, Heft VIII. 1909, p. 382.

B. 6; D. 17—19; A. 17—18; P. 15—16; V. 8; L. l. 43—45; L. tr. 10—12.

Abdominal profile a little more or not more convex than dorsal. Height $3^1/_2$—4; head $3^1/_2$—4; eye $2^3/_4$—$3^1/_4$, as long as postorbital part of head or a little shorter, about $^1/_4$ longer than snout. Maxillary reaches not farther than middle of eye, twice or a little more in head; 3—8 diverging postfrontal striae. Operculum twice as high as broad, suboperculum rhombic its, posterior inferior corner rounded, its length twice its height. Venules on cheeks, postorbital part of head and opercles extending a little way on body behind opercles. Dorsal up to one eye diameter nearer to caudal than to snout. Distance from origin of dorsal to base of caudal $1^1/_5$—$1^1/_7$ times its distance from snout. Length of dorsal equals its height, which equals length of eye and snout or $^2/_3$ of the height of the body. Anal shorter than dorsal. Pectorals as long as head without snout. Origin of ventrals before middle of dorsal. Caudal longer than head, $5^1/_4$—6 in total length. Teeth on palatines, pterygoids and tongue. Gillrakers 32, coarse, longest $^1/_2$ of eye, shorter than breadth of operculum. Scales vertically striped, their margin crenulated or identated,

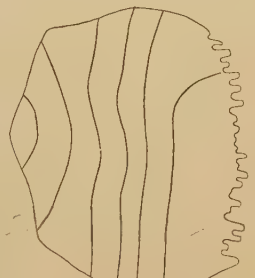

Fig. 28.
Scale of Clupea (*Harengula*) *moluccensis* Blkr. × 6.

rather firm, 12—15 praedorsal median scales, 16—18 praeventral, 13 postventral scutes. Silvery, back and snout dark. Fins hyaline, dorsal often anteriorly dark-coloured, as also the caudal or its margin. Length nearly 160 mm.

Habitat: Sumatra (Trussan, Padang, Tiku, Priaman, Siboga); Nias!; Pulu Weh!; Singapore; Biliton; Celebes (Macassar, Bonthain, Menado); Bali; Sumbawa; Buru; Ceram!; Ambon!; Saparua; Solor; Timor; Batjan; Ternate; Waigeu!; Kei Islands!. — Australia?; New Hebrides; Solomon Islands; Admirality Islands; Marshall Islands; Fidji Islands; Philippines; China; Japan; Andamans; Nicobars; Ceylon.

In Sea.

13. Clupea (Harengula) longiceps (C. V.)

Sardinella longiceps Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 273.
Sardinella Neohowii Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 274.
Alosa scombrina Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 442.
Sardinella lemuru Bleeker, Nat. Tijdschr. Ned. Indië, IV. 1853, p. 500.
Clupea lemuru Günther, Cat. Brit. Mus. VII. 1868, p. 430.
Clupea scombrina Günther, Cat. Brit. Mus. VII. 1868, p. 448.
Clupea (*Harengula*) *lemuru* Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 108.
Clupea longiceps Day, Fishes of India 4°. 1878—1888, p. 637.

B. 6; D. 16—18; A. 13—16; P. 15—16; V. 8—9; L. l. 45; L. tr. 12—13.

Elongate, dorsal and ventral profile evenly convex. Height $4—4^1/_3$, head $3^3/_4—4$, eye $4—4^1/_2$, shorter than snout and much shorter than postorbital part of head. Maxillary reaches beyond frontmargin of eye, about $2^1/_2$ in head. About 8—10 diverging postfrontal striae. Operculum twice as high as broad. Suboperculum rectangular, its lower posterior angle rounded. Dorsal somewhat nearer to caudal than to snout, its origin distinctly nearer to snout. Height of dorsal somewhat more than its length, which equals the postorbital part of head. Length of anal equals half length of head. Pectorals somewhat shorter than head without snout. Origin of ventrals behind middle of dorsal. Caudal $5^1/_4—6$ in the total length. Teeth on palatines, pterygoids and tongue. Gillrakers circa 120, the longest nearly as long as eye, less than half breadth of operculum. Scales smooth, irregularly crenulated; 13—15 praedorsal scales, 18 praeventral and 14 postventral abdominal scutes. Silvery above, brownish on the back. Sometimes a

brownish spot on operculum. Fins hyaline, caudal and dorsal more or less dusky. Length about 160 mm.

Nom. indig.: Lemuru.

Habitat: Java (Batavia, Banjuwangi!); Bali straits!. — British India.

In Sea.

14. Clupea (Harengula) pinguis Gthr.

Clupea pinguis Günther, Brenchley's Cruise of the Curaçoa 1873, p. 426.

B. 5; D. 17; A. 19; P. 18; L. l. 43; L. tr. 13.

Elongate, dorsally and ventrally equally very slightly convex. Height 5, head $4^1/_5$; eye about 4, somewhat shorter than snout and conspicuously shorter than postorbital part of head. Lower jaw but slightly projecting beyond the upper, maxillary extending to below the frontmargin of the eye. 11—13 diverging postfrontal striae. Operculum more than twice as high as broad, suboperculum with the lower posterior corner rounded, more than twice as long as high. Dorsal nearer to caudal than to snout, its origin as much nearer to snout than to caudal as the length of the postorbital part of head. Ventrals about 3 in head, inserted below the anterior $^1/_3$ of the dorsal. Pectorals nearly equal to head without snout. Caudal deeply forked. Teeth none. Scales striated and with rounded crenulations, about 14 praedorsal scales, 16 praeventral and 14 postventral scutes. Back bluish green, sides silvery, both colours being sharply defined from each other. Length 125 mm.

[Type in the British Museum examined].

Habitat: Misol.

In Sea.

15. Clupea (Harengula) schrammi (Blkr).

Alosa Schrammi Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichth. Bali, p. 11.
Meletta Schrammi Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 30.
Clupea (Harengula) Schrammi Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872. p. 110.
Clupea venenosa Steindachner, Abh. Senckenb. Naturf. Ges. XXV. 1901, p. 456, (nec C. venenosa C.V.; Steindachner's specimen examined).

B. 6; D. 18—19; A. 18—20; P. 16; V. 8; L. l. 45; L. tr. 9—11.

Elongate, dorsally and ventrally almost equally convex. Height $4^1/_2$—5, head about 4, eye 3—$3^1/_2$, about as long as snout, about $^1/_4$ shorter than postorbital part of head. Maxil-

lary reaches somewhat beyond frontmargin of eye, about 2 times in length of head. 3—5 diverging postfrontal striae. Operculum more than twice as high as broad, suboperculum rectangular, lower posterior corner rounded, hindmargin of praeoperculum straight. Dorsal about half the diameter of the eye nearer to caudal than to snout, its origin one eye-diameter nearer to snout than to caudal. Length and height of dorsal both equal to snout and eye. Anal as long as dorsal. Pectorals longer than head without snout. Ventrals nearly under the middle of the dorsal. Caudal $6^1/_3$ in total length. Teeth on the tongue only. Gillrakers 32, the longest about half length of eye. Scales very thin, feebly crenulated. Praedorsal scales about 14—15; 17 praeventral, 13 postventral scutes. Silvery, back dark bluish. Fins hyaline. Length about 100 mm.

Habitat: Bali; Ambon!; Batjan! — In sea.

4. **Pellona** C. V.

(Cuvier & Valenciennes. Hist. Nat. Poissons XX, 1847, p. 300).

Platygaster Swainson (name preoccupied).
Ilisha (Gray) Richardson (no description).

Oblong, much compressed, convex, ventral profile strongly serrated by thoracal and abdominal scutes. Scales of moderate size, thin, deciduous. Lower jaw prominent, cleft of mouth oblique, of moderate width. Oral border of upper jaw with a ligament between lateral end of intermaxillary and prominent middle of maxillary, which ligament may be replaced by a small toothed supplementary bone. Two other supplemental bones along the dorsal border of the maxillary. Minute teeth on the jaws, in rasp-like bands on palatines, pterygoids and tongue, none on vomer. Ventral fins very small. Upper pectoral ray strong and broad. Anal fin long, $2^1/_2$—3 in length, with 33—54 rays. Its origin below or just behind dorsal, the origin of which is behind ventrals. Caudal fin deeply forked. Gillrakers stout, not numerous (about 20), spinulous all round.

Nomen indig.: Mata besar, Bulan bulan (Malay.).

Synopsis of the species.

A. Oral border of upper jaw with a supplemental bone situated between lateral end of intermaxillary and prominent middle of maxillary . . . . . *P. hoevenii* p. 86.

B. Oral border of upper jaw with a ligament in stead of a supplemental bone between lateral end of intermaxillary and maxillary.

I. Up to 45 scales in L. l., 23—28 abdominal scutes.

a. Height about $3^3/_4$, posterior half of dorsal opposite to anal. Anal about 3 times in length. A. circa 42 . . . . . *P. kampeni* p. 87.

b. Height $2^1/_2$—$2^3/_5$.

1. Anal $2^2/_5$—$2^1/_2$, origin of anal behind dorsal. L. l. 40—42. A. 47—48 . . . . . *P. brachysoma* p. 87.

2. Anal 3, origin of anal below last dorsal rays. L. l. 45. A. 37—39. . . . . *P. ditchoa* p. 88.

II. More than 45 scales in L. l., 28—39 abdominal scutes.

a. At least a part of the anterior half of the dorsal is situated above the anal.

1. 35 abdominal scutes. L. l. 50. A. 40. Anal $2^1/_2$ in length . . . . . *P. pristigastroides* p. 89.

2. 38—39 abdominal scutes. L. l. 50—54. A. 47—53. Anal $2^2/_3$—$2^3/_4$ in length . . . . . *P. amblyuropterus* p. 90.

b. Only the posterior half of the dorsal or part of it opposite to anal.

1. Anal 3, height 3—4 in length.

α. Ventrals in middle between anal and suboperculum.

aa. Origin of anal nearly opposite to end of dorsal. Greatest convexity of ventral profile near ventrals. Maxillary reaching to middle of eye, which goes 4 times or less in head. . . . *P. elongata.* p. 90.

bb. Origin of anal opposite to posterior half of dorsal. Greatest convexity of ventral profile near base of pectorals. Maxillary reaching to hindpart of eye, which goes more than 4 times in head . . . . . *P. novacula* p. 92.

β. Ventrals much nearer to anal than to suboperculum. Origin of anal opposite to hindermost rays of dorsal . . . . . *P. dussumieri* p. 92.

2. Anal $2^1/_2$—$2^3/_4$, height $2^2/_3$—$3^1/_4$ in length.

α. Ventral much nearer to anal than to

suboperculum. Anal $2^1/_2$ in length. Greatest convexity of abdominal profile before base of pectorals . . . . . *P. macrogaster* p. 93.

β. Ventrals situated midway between anal and suboperculum. Anal $2^2/_3$—$2^3/_4$. Greatest convexity of abdominal profile between pectorals and ventrals. . . *P. xanthoptera* p. 94.

1. Pellona hoevenii Blkr.

Pellona Hoevenii Bleeker, Verh. Bat. Gen. XXIV. 1852. Haringacht., p. 21.
Pellona hoevenii Günther, Cat. Brit. Mus. VII. 1868, p. 455.
Ilisha Hoevenii Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 117.
Pellona Hoevenii Day, Fishes of India 4°. 1878—1888, p. 644.

B. 6; D. 17—18; A. 33—37; P. 18; V. 7; L. l. 40—45; L. tr. 12—13.

Oblong, compressed, lower profile not much more convex than dorsal. Height $2^3/_4$—3, head 3—$3^1/_4$, eye $2^3/_4$—3, $^1/_4$ longer than snout, about as long as postorbital part of head. On each side of the head a pair of parallel lines, which diverge hindwards, till a point on the occiput where the two lines meet in one ridge which converges hindwards with that of the other side. Maxillary reaches about to below the middle of eye, 2 in head. Its oral border is supplemented by a small toothed bone, which reaches from the lateral end of the intermaxillary to the prominent middle of the maxillary. There are two dorsal supplemental bones, the larger of which reaches nearly to the hindborder of the maxillary. Origin of dorsal midway between caudal and snout or a little nearer to the lastnamed, a little behind origin of ventrals, which are situated much nearer to anal than to suboperculum. Ventrals much smaller than eye. Pectorals shorter than head without snout, not reaching to ventrals. Anal $3^1/_2$—$3^2/_3$ in length (without caudal), its origin below or a little before base of last dorsal ray. Caudal scaly, deeply incised nearly as long as head. Teeth on palatines, pterygoids, tongue and small

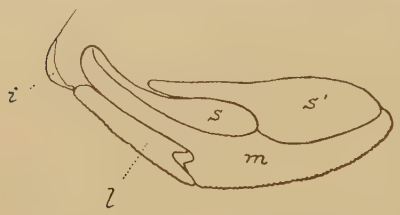

Fig. 29. *Pellona hoevenii* Blkr.

i Intermaxillary, *m* maxillary, *l* ossified ligament between them, *s s'* supplemental bones. × 3.

ones in a single series on jaws. Gillrakers about 20—23, $^1/_3$ longer than branchial filaments, shorter than pupil. Scales deciduous, thin, with a single vertical line, margin slightly and irregularly crenulated. 23—27 abdominal scutes, about 9 of which are postventral. Silvery with a brownish back (in alcohol). Fins hyaline, margin of dorsal and caudal more or less dark. Length about 180 mm.

Habitat: Java (Batavia!, Bantam, Anjer, Tjiringin); Sumatra (Padang, Tiku, Priaman); Singapore; Celebes (Macassar!, Bonthain; Badjoa; Pare Pare!); Halmahera (Sindangola); Obimajor; Ambon; Ceram (Wahai). — Philippines; Siam to Coromandel coast of India.

In sea.

2. **Pellona kampeni** n. sp.

B. 6; D. 15—16; A. 42; P. 15; V. 7; L. l. about 44; L. tr. about 15.

Oblong, compressed, ventral profile a little more convex than dorsal one, profile of nape straight. Height $3^3/_4$, head $3^4/_5$, eye about 3; as long as snout. Two pairs of diverging ridges on the surface of the head, the posterior portions of which run nearly parallel. Maxillary reaches to below middle of eye, twice in head, its oral border without supplemental bone (cf. *P. hoevenii*) but with a ligament instead. Chin very prominent. Origin of dorsal a little nearer to snout than to caudal, nearly in the middle, $1^1/_3$ diameter of eye behind ventrals, which are situated nearer to the anal than to the suboperculum. Ventrals very short. Anal almost 3 in length, its anterior part opposite to posterior half of dorsal. Caudal deeply incised. Scales deciduous, thin, smooth, 25—26 abdominal scutes, 7 behind ventrals. Gillrakers 20, spinulous all round, a little longer than branchial filaments, $^3/_4$ of pupil. Length 150 mm.

Habitat: Java (Batavia!); Borneo (Balikpapan!).

In sea and estuaries.

3. **Pellona brachysoma** Blkr.

Pellona brachysoma Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht. p. 22.
Pellona brachysoma Günther, Cat. Brit. Mus. VII. 1868, p. 456.
Ilisha brachysoma Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 118.
Pellona brachysoma Day, Fishes of India 4°. 1878—1888, p. 645.

B. 6; D. 16—17; A. 47—49; P. 16; V. 7; L. l. 40—42; L. tr. 15—16.

Oblong, compressed, ventral profile regularly curved, much more convex than dorsal one. Height $2^1/_2$—$2^3/_5$, head $3^1/_2$—$3^2/_3$, eye $2^1/_2$—$2^3/_4$, longer than snout. Two pairs of diverging lines on surface of head, posterior halves of which run parallel. Maxillary reaches below middle of eye, about 2 in length of head. Oral border of maxillary without supplementary bone (cf. *P. hoevenii*) but with a ligament instead. Origin of dorsal distinctly nearer to snout than to caudal, behind the origin of ventrals, which are shorter than eye and much nearer to anal than to suboperculum. Pectorals nearly as long as head without snout, nearly reaching to ventrals. Anal $2^2/_5$—$2^1/_2$ in length, its origin behind the dorsal. Caudal scaly, deeply incised, $3^2/_5$—$3^1/_2$ in length. Scales generally with vertical lines, convex, hindmargin smooth. 25—26 abdominal scutes. Silvery, back dark. Fins hyaline. Dorsal powdered with brown. Length up to 170 mm. [Not seen by us].

Habitat: Java (Batavia); Sumatra (Priaman, Padang); Singapore. — British India.

In sea.

4. Pellona ditchoa C. V.

Platygaster indicus Swainson, Nat. Hist. Fishes II. 1830, p. 294. (Name only).
Pellona ditchoa Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 313.
Pellona ditchoa Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 24.
Pellona ditchoa Günther, Cat. Brit. Mus. VII. 1868, p. 455.
Ilisha indica Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 118.
Pellona indica Day, Fishes of India 4°. 1878—1888 p. 644.
Pellona indica Pfeffer, Die Fische Ost-Afrikas, 1896. p. 69.

B. 6; D. 16—17; A. 37—39; P. 16; V. 7; L. l. 45; L. tr. 14—15.

Oblong, compressed, ventral profile much more convex than the dorsal, strongest convexity below ventrals. Height $2^1/_2$—$2^3/_5$, head $3^1/_5$—$3^4/_5$, eye $2^1/_2$—3, $^1/_3$ longer than snout, nearly equalling postorbital part of the head. Ridges as on head of *P. hoevenii*, but their posterior half parallel. Maxillary reaches below first half of eye, about 2 times in head. Oral border of maxillary without a supplementary bone (cf. *P. hoevenii*) but with a ligament instead. Second supplemental bone reaching to hindborder of maxillary. Origin of dorsal nearer to snout than to caudal, about half eye length behind origin of ventrals, which are nearer to anal than to suboperculum. Ventrals shorter than eye. Pectorals as long as head without snout,

reaching to ventrals in adults. Anal about 3 times in length, its origin below base of last dorsal ray. Caudal scaly, about $3^1/_2$ in length. Teeth on palatines, pterygoids and tongue, small ones in a single series in jaws. Gillrakers 24, almost $^1/_2$ longer than filaments, as long as pupil. Scales deciduous, thin, with some vertical lines and an irregularly crenulated hindmargin. 26—28 abdominal scutes, 8—9 being postventral. Colour silvery, back brownish (in alcohol), fins hyaline, dorsal and caudal powdered with brown. Length about 160 mm.

Nomen indig.: Dĕrŏ. juveniles: Longlong mata (Java).

Habitat: Java (Batavia!, Samarang, Surabaya, Pasaruan, Kendal! Palabuan Batu!); Sumatra (Benkulen, Tiku, Priaman Bagan api api!) Madura; Singapore; Banka. — Westward to coast of East-Africa.

In sea.

5. Pellona pristigastroides Blkr.

Pellona pristigastroides Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 20.
Pellona pristigastroides Günther, Cat. Brit. Mus. VII. 1868, p. 459.
Ilisha pristigastroides Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872. p. 121.

B. 6; D. 17; A. 40; P. 15; V. 6; L. l. 50; L. tr. 14—15.

Oblong, compressed, ventral profile especially anteriorly much more convex than dorsal profile, that of the nape concave. Height $3^1/_4$, head $4^1/_4$, eye 4, about equal to snout, much shorter than postorbital part of head. Posterior halves of the ridges on the upper surface of the head slightly divergent behind. Maxillary reaches to middle of eye, about twice in head, its oral border without supplemental bone (cf. *P. hoevenii*) but with a ligament in stead. Origin of dorsal nearer to caudal than to snout, far behind origin of ventrals, which are rudimentary and a little nearer to anal than to suboperculum. Pectorals about as long as head without chin, reaching farther than ventrals. Anal $2^1/_2$, its anterior part opposite to nearly the entire dorsal. Caudal scaly, deeply incised, 5 in length. 16 gillrakers, spinulous all round, longer than branchial filaments; equal to half eye. Scales sometimes with transverse lines, their hindmargin convex and smooth. 35 abdominal scutes, 12 of which behind ventrals. Silvery, yellowish or bluish above, fins hyaline, margin of caudal powdered with brown. Length more than 180 mm. [Type in British Museum examined].

Habitat: Java (Batavia); Borneo (Sinkawang, Sadong). In sea and mouth of rivers.

6. **Pellona amblyuropterus** Blkr.

Pellona amblyuropterus Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 21.
Pellona amblyuropterus Günther, Cat. Brit. Mus. VII. 1868, p. 459.
Ilisha amblyuropterus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872. p. 122.

B 6; D. 17; A. 47—53 (44 Günther); P. 14—15; V. 6—7; L.l. 50—54; L. tr. 15—16.

Oblong, compressed, ventral profile more convex than the dorsal. Profile of the nape slightly concave. Height $3^1/_3$, head $3^4/_5$—4, eye 4—$4^1/_4$, longer than snout. Posterior halves of the ridges on the upper surface of the head divergent behind. Maxillary denticulated, in fullgrown specimens reaching to posterior half of the eye, 2 times and a little in head, its oral border without supplemental bone (cf. *P. hoevenii*) but with a ligament instead. Origin of dorsal conspicuously nearer to caudal than to snout, far behind origin of ventrals, which are much nearer to anal than to suboperculum. Ventrals very short. Pectorals nearly as long as head without chin, shorter when fullgrown, nearly reaching the ventrals. Anal $2^2/_3$—$2^3/_4$ in length, its anterior part opposite to nearly the entire dorsal. Caudal scaly, deeply incised, $4^3/_5$—6 in length. Scales very thin, sometimes with transverse lines, their hindmargin smooth; 38—39 abdominal spines, 11 of which behind ventrals. 16—17 gillrakers, spinulous all round, longer than branchial filaments, a little shorter than $^1/_2$ eye. Silvery, darker above, fins hyaline, dorsal and caudal more or less powdered with brown, inside and superior border of pectorals yellow. Length over 450 mm.

[Specimens of Bleeker's collection in the Leyden Museum examined].

Nomen indig. Ikan Puput (Bagan Api Api, Sumatra).

Habitat: Java (Batavia); Sumatra (Bagan Api Api!); Singapore; Borneo (Sungiduri).

In sea and brackish water.

7. **Pellona elongata** (Benn.)

Alosa elongata Bennet, Mem. Life Raffles, 1830. p. 691.
Clupea melastoma Bleeker, Nat. Gen. Arch. Ned. Indië II. 1845, p. 509. (nec Bl.).
Pellona grayana Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 315.

Pellona affinis Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1273.
Pellona grayana Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 25.
Pellona grayana Kner, Novara Exp. Fische 1865—1867, p. 328.
Pellona elongata Günther, Cat. Brit. Mus. VII. 1868, p. 456.
Ilisha elongata Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 119.
Pellona elongata Day, Fishes of India 4°. 1878—1888, p. 643.
Ilisha elongata Jordan & Herre, Proc. U. S. Nat. Mus. XXXI. 1907, p. 635.

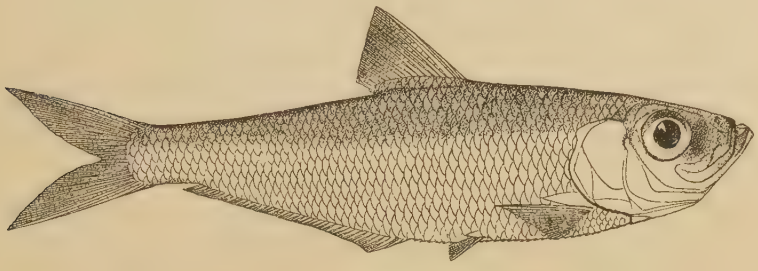

Fig. 30. *Pellona elongata* (Benn.)

B. 6; D. 15—17; A. 40—50; P. 15—17; V. 7; L. l. 50—53; L. tr. 15—16.

Oblong, compressed. Ventral profile much more convex than dorsal one, especially before ventrals. Height 3—$3^3/_4$, head $3^2/_3$—4, eye $3^1/_4$—4, equals snout in adults. Two pairs of diverging ridges on the upper surface of the head, the posterior halves of which run nearly parallel. Maxillary reaches middle of eye, 2—$2^1/_5$ in head. Oral border of maxillary without a supplementary bone (cf. *P. hoevenii*) but with a ligament instead. Origin of dorsal midway between snout and caudal or slightly nearer to lastnamed, far behind origin of ventrals, which are situated nearly in the middle between anal and suboperculum. Ventrals shorter than eye. Pectorals about as long as head without snout, reaching to the ventrals or not so far. Anal 3 times or a little more in length. Its origin below the end of the base of the dorsal or very little before it. Caudal scaly, deeply incised, $3^3/_4$—$4^1/_4$. Teeth on palatines, pterygoids and tongue. Gillrakers 21, stout. Scales thin, deciduous, generally with a few vertical lines, hindmargin smooth. 32—36 abdominal scutes. Colour silvery, dark above. Fins hyaline, margin of dorsal and upper, under and hindmargin of caudal darker. Length over 400 mm.

Habitat: Java (Batavia!, Samarang, Surabaya); Madura; Sumatra (Benkulen, Telokbetong, Palembang); Pinang; Singa-

pore; Banka; Borneo (Pamangkat, Sinkawang). — China; Formosa; Japan; British India.

In sea and mouth of rivers.

8. Pellona novacula C. V.

Pellona novacula Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 319.
Ilisha novacula Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 302. — Atl. Ichth. VI. livr. 25, 26. 1872, p. 120.
Pellona novacula Günther, Cat. Brit. Mus. VII. 1868. p. 458.

B. 6; D. 17—18; A. 42; P. 1/15; V. 1/6; L. l. 45—50; L. tr. 14—15.

Greatest convexity of ventral profile below base of pectorals. Height $3^1/_2$, head $3^3/_4$, eye about 4, about equal to snout and nearly half as long as postorbital part of head. The posterior halves of the ridges on the upper surface of the head slightly divergent. Maxillary reaches to below hinder half of eye, nearly twice in head measured with chin. Oral border of maxillary without a supplementary bone (cf. *P. hoevenii*), but with a ligament instead. Origin of dorsal nearer to root of caudal than to end of snout, far behind ventrals, which are shorter than the eye and situated about in the middle between anal and suboperculum. Pectorals about as long as head without snout, not reaching ventrals. Anal about 3 in length. Its origin below the posterior half of the dorsal. Caudal scaly, deeply incised. Teeth on palatines, pterygoids and tongue. 20 gillrakers, $^1/_3$ longer than branchial filaments. Scales more or less distinctly striated. 33 abdominal scutes, 10 of which postventral. Colour silvery, dark above. Length 230 mm. [Bleeker's specimen seen in British Museum].

Habitat: Batavia (once recorded by Bleeker). — Rangoon; China.

In sea.

9. Pellona dussumieri C. V.

Platygaster megalopterus Swainson, Nat. Hist. Fish. II. 1830, p. 294. (Name only).
Pellona dussumieri Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 316.
Pellona Leschenaultii Bleeker, Verh. Bat. Gen. XXIII. 1850, Bijdr. M. en O. Java, p. 11 (nec C. V.).
Pellona Russelli Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 23.
Pellona motius Günther, Cat. Brit. Mus. VII. 1868, p. 456. (ex parte).
Ilisha megalopterus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 119.
Pellona megalopterus Day, Fishes of India 4°. 1878—1888, p. 645.

B. 6; D. 17—18; A. 41—44; P. 16—17; V. 7; L. l. 48—50; L. tr. 14—15.

Oblong, compressed, ventral profile not much more convex than dorsal profile. Height 3—3 1/4, head 3 1/5—3 1/2, eye 3—3 1/4, 1/4 longer than snout, equalling postorbital part of head. Dorsal surface of head with two pairs of slightly diverging ridges. Maxillary reaches middle of eye, about 2 times in head. Oral border of maxillary with a ligament to the posterior end of intermaxillary. Its posterior end broadly rounded, reaching a little farther than the end of the second supplemental bone. Chin very prominent. Origin of dorsal about midway between snout and base of caudal, 3/4 diameter of eye behind origin of ventrals, which are much shorter than eye and much nearer to anal than to suboperculum. Pectorals about as long as head without snout, reaching to the ventrals. Anal about 3 times in length of body, its origin below hindermost rays of dorsal. Caudal 3 1/2—3 3/4 in length. Teeth on pterygoids, palatines and tongue, a single series of small ones in the jaws. Gill-rakers about 21, 1/3 longer than branchial filaments, shorter than pupil. 28—31 abdominal scutes, 9—11 behind ventrals. Scales thin, deciduous, with one vertical line, hindmargin nearly smooth. Colour silvery, back brown (in alcohol), fins hyaline. Dorsal and caudal bordered with dark. Length more than 300 mm.

Nomen indig.: Ikan puput (Bangan Api Api).

Habitat: Java (Batavia!, Samarang, Surabaya, Pasaruan); Madura; Singapore; Sumatra (Bagan Api Api!); Bintang; Banka; Borneo (Sambas, Kota baru!, Pamangkat); Ambon. — British India.

In sea and mouth of rivers.

10. Pellona macrogaster (Blkr.)

Ilisha macrogaster Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 300.
Pellona macrogaster Günther, Cat. Brit. Mus. VII. 1868, p. 458.
Ilisha macrogaster Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 121.

B. 6; D. 16; A. 47; P. 15; V. 6—7; L. l. 50; L. tr. 15—16.

Oblong, compressed, ventral profile, especially anteriorly much more convex than dorsal profile, that of the nape nearly straight. Height 2 4/5, head 3 3/4, eye about 2 1/2, about double as long as snout. Posterior third of the ridges on the upper-surface of the head parallel to each other. Maxillary reaches

under the anterior half of the eye, about twice in head, oral border of maxillary without supplemental bone (cf. *P. hoevenii*), but with a ligament instead. Origin of dorsal about in the middle between snout and caudal, far behind the origin of ventrals, which are situated much nearer to anal than to suboperculum. Ventral fins exceedingly short. Pectorals a little shorter than head without chin, reaching to ventrals. Anal $2^1/_2$ in length, its origin below posterior half of dorsal. Caudal scaly, deeply incised, 5 in length. Scales with faint vertical lines, hindmargin smooth. 36—37 abdominal scutes, about 9 behind ventrals. Silvery, above dark, fins hyaline. Length 150 mm. [Not seen by us].

Habitat: Borneo (Sambas, Serawak).

In rivers.

11. **Pellona xanthoptera** Blkr.

Pellona xanthopterus Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 439.
Pellona xanthoptera Günther, Cat. Brit. Mus. VII. 1868, p. 457.
Ilisha xanthopterus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 122.

B. 6; D. 16—17; A. 47—50; P. 15—16; V. 7; L. l. circa 50; L. tr. 16.

Oblong, compressed, ventral profile much more convex than dorsal one, especially convex a little before ventrals. Height 3, head $3^3/_4$—4, eye $2^2/_3$ to more than 3, much longer than snout. Dorsal surface of head concave, with two pairs of diverging ridges, the posterior halves of which are parallel. Maxillary reaches to middle of eye, 2—$2^1/_5$ in head. Oral border of maxillary without supplementary bone (cf. *P. hoevenii*), but with a ligament instead. Origin of dorsal midway between snout and caudal, far behind origin of ventrals, which are situated about the middle between anal and suboperculum. Ventrals shorter than eye. Pectorals as long as head without chin, reaching much farther than base of ventrals. Length of anal $2^2/_3$—$2^3/_4$ in length of body, its origin below the hinder end of the base of the dorsal or below its last rays. Caudal scaly, deeply incised, 5—$5^1/_2$ in length. Teeth on pterygoids, palatines, tongue and jaws. Gillrakers 24, about as long as branchial filaments, about $^2/_5$ of eye. Scales thin, deciduous, shiny, with concentric lines, hindmargin rough. 35—37 abdominal scutes, 10—12 of which postventral. Yellowish silvery. Fins hyaline.

Length over 360 mm. [Specimen of Bleeker's collection in the Leyden Museum examined].

Habitat: Java (Krawang!); Borneo (Sambas, Pamangkat Sarawak).

In rivers and brackish water.

5. Ophisthopterus Gill.

(Gill. Proc. Acad. Nat. Sc. Philadelphia 1861, p. 31).

(*Pristigaster* Gthr. p. p. [1]).

Oblong, strongly compressed, ventral profile strongly serrated, especially convex between chin and pectorals. Lower jaw projecting, maxillary vertical, rounded behind, reaching farther than its supplemental bone but not produced. Small teeth on jaws, palatines, pterygoids and tongue, none on vomer. Dorsal fin short, inserted far behind origin of anal. Anal long with more than 50 rays. Ventrals wanting. Caudal deeply forked. Scales moderate, thin, deciduous. Gillrakers 28—30, stout, much longer than branchial filaments.

Synopsis of the species.

A. Maxillary twice in head, supplementary bone reaching as far as maxillary (see fig. 31). Pectorals shorter than head . . . . . *O. tartoor* p. 95.

B. Maxillary $1^1/_2$—$1^4/_5$ in head, excluding the supplementary bone totally from the caudal border of the upper jaw (see fig. 32). Pectorals longer than head . . . . . *O. macrognathus* p. 96.

1. Opisthopterus tartoor (C. V.)

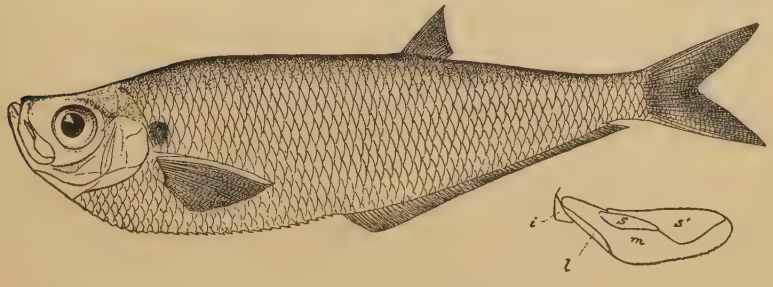

Fig. 31. *Opisthopterus tartoor* (C. V.)

i Intermaxillary, *m* maxillary, *l* ligament between them, *s s'* supplemental bones.

1) See Max Weber & L. F. de Beaufort, Verhand. Akademie Amsterdam XVII, N°. 3, 1912, p. 9.

Pristigaster tartoor Cuvier & Valenciennes, Hist. Nat. Poissons XX. 1847, p. 328.
Pristigaster tartoor Bleeker, Verh. Bat. Gen. XXIV. 1852, Haringacht., p. 25, (ex parte).
Opisthopterus tartoor Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 296.
Pristigaster tartoor Günther, Cat. Brit. Mus. VII. 1868, p. 460.
Opisthopterus tartoor Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 123.
Opisthopterus tartoor Day, Fishes of India 4°. 1878—1888, p. 646.

B. 6; D. 15—17; A. 56—66; P. 14—16; L. l. 50—54; L. tr. 12—13.

Elongate, very compressed, very convex from chin to anal. Dorsal profile of head concave, of back slightly convex. Height $3^1/_3$—$3^3/_4$, head about 5, eye $2^3/_4$—3, much longer than snout and shorter than postorbital part of head. Maxillary twice in head, its supplementary bone reaches nearly as far as the maxillary itself, the ventral border of which is denticulated. Operculum rounded behind, praeoperculum triangular. Distance of the origin of the caudal to the end of the snout is $1^3/_4$ times its distance from the snout. The origin of the dorsal lies more than twice the length of the dorsal behind the vertical through the origin of the anal. Pectorals somewhat shorter than head. Scales deciduous, 28—30 sharp keeled and curved abdominal scutes. Teeth on the jaws, palatines, pterygoids and tongue. Gillrakers 28, stout, spinulous all round, twice as long as the branchial filaments, as long as pupil. Silvery, except on the back, a dark patch behind upper angle of operculum. Fins hyaline. Caudal with a dusky margin. Length over 200 mm.

Nomen indig: Kèntut (Batavia).

Habitat: Java (Batavia!; Palabuan Batu); Sumatra (Bagan Api Api!). — British India.

In sea.

2. Opisthopterus macrognathus Blkr.

Pristigaster tartoor Bleeker, Verh. Bat. Gen. XXIV. Haringacht., p. 25 (ex parte).
Opisthopterus macrognathus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 299.
Pristigaster macrognathus Günther, Cat. Brit. Mus. VII. 1868. p. 461.
Opisthopterus macrognathus Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 124.

B. 6; D. 16—17; A. 59—63; P. 13; L. l. 45—52; L. tr. 12—13.

Elongate, very compressed, very convex from chin to anal. Dorsal profile of head concave, back convex. Height $3^1/_4$—$3^1/_2$, head about 5, eye about 3, $^1/_4$ longer than snout, less than

postorbital part of head. Maxillary about twice in head, nearly vertical, its ventral border denticulated in its anterior half, its broad caudal end reaching farther than the broad caudal end of the supplementary bone. Operculum rounded behind, oblique below, praeoperculum triangular. The distance between the origin of dorsal and caudal is a little longer than half its distance from snout. Origin of dorsal more than twice the length of the dorsal behind the vertical through origin of anal. Pectorals much longer than head. Scales deciduous, not or irregularly striated. Thirty to 33 sharp, keeled and curved abdominal scutes. Teeth on jaws, palatines, pterygoids and tongue. Gillrakers about 30, stout, minutely spinulous all round, much longer than branchial filaments, about as long as pupil. Silvery, except on the back, sometimes a dark patch on the upper part of operculum. Fins hyaline. Length up to 225 mm.

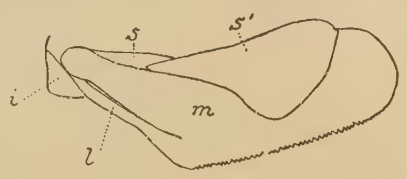

Fig. 32. *Opisthopterus macrognathus* Blkr.

i Intermaxillary, *m* maxillary, *l* ligament between them, *s s'* supplemental bones. × 3.

Nomen indig: Lipiram (Javan.).

Habitat: Java (Batavia! Tjilatjap!); Sumatra (Benkulen, Padang, Priaman); Singapore; Borneo (Sinkawang, Sampit, Sarawak, Matang). — Sea and estuaries.

6. **Raconda** (Gray) Cantor.

(Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1274).

Oblong, much compressed, belly very convex, abdomen feebly serrated. Scales moderate, thin, very deciduous. Lower jaw projecting, maxillary tapering behind and produced as far as gillopening in adults. Teeth minute, in the jaws in a single series, in velvety patches on palatines, pterygoids and tongue, none on vomer. Dorsal and ventral fins wanting. Anal long, with more than 80 rays, upper pectoral ray enlarged. Caudal deeply forked. Pseudobranchiae well developed.

1. **Raconda russelliana** Gray.

Raconda russelliana Gray, Zool. Miscell. 1831, p. 9.
Raconda russelliana Cantor, Journ. Asiatic Soc. of Bengal, XVIII. 1850, p. 1274.

Pristigaster russellianus Günther, Cat. Brit. Mus. VII. 1868, p. 462
Raconda russelliana Bleeker, Atl. Ichth. VI. livr. 25, 26. 1872, p. 124.
Raconda russelliana Day, Fishes of India 4°. 1878—1888, p. 646.

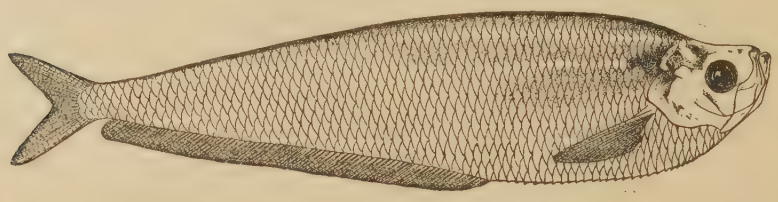

Fig. 33. *Raconda russelliana* Gray.

B. 6; A. 83—92; P. 13; L. l. 60—64; L. tr. 12.

Oblong, strongly compressed, anterior portion of ventral profile very convex. Dorsal profile concave above the orbits. Height $3^4/_5$, head $5^3/_4$, eye $3—3^1/_4$, longer than snout. Maxillary reaching to middle of eye, in adults as far as gillopening. Pectorals about as long as head without chin. Caudal deeply forked, the lower lobe the longer. Gillrakers about 22, less long than half eye. Scales very deciduous, in regular horizontal rows. 31—38 feeble abdominal scutes. A narrow dark blackish band along the back, sides yellowish, below silvery. A deep brown or black spot on the shoulder, sometimes continued on to the opercle. Length about 200 mm.

Habitat: Sumatra (Bagan Api Api!), Singapore. — Malay Peninsula to Bay of Bengal. — In sea, near shore.

7. Fam. Alepocephalidae.

Elongate, compressed. Head almost always naked. Body covered with thin cycloid scales, at least in the lateral line. Barbels none. Nostrils close to the eye. Mouth moderate or large, its upper margin formed by intermaxilla and maxilla. The intermaxilla being placed along the anterior inferior edge of the latter, which has a supplemental bone at its hindpart. Feeble teeth on mandibles, intermaxilla, sometimes on maxilla and mostly on palatines. No adipose fin. Anal more or less below dorsal. Pectorals placed rather high; ventrals about in the middle of the length of the body, sometimes wanting. Anus behind middle of body. Opercles complete, but very thin. Gillopening very wide, partially covered by a continuation of the skin of the head and by the gillmembranes, which are

free from the isthmus and overlap each other. Pseudobranchiae present. Gillrakers long and numerous. No gular plate.

Synopsis of the genera.

A. Scales well developed. Teeth on the palate.
  a. Teeth on intermaxilla, mandible and palatines only . *Alepocephalus* p. 99.
  b. Teeth also on the maxillary and vomer . . . . . *Bathytroctes* p. 101.
B. Scales if present on lateral line. Palate toothless . . . . *Aleposomus* p. 104.

1. Alepocephalus Risso.

(Risso, Mém. de l'Acad. Sc. Torino XXV. 1820, p. 270).

(*Mitchillina* Jordan & Evermann).

Oblong, compressed, covered with rather large, cycloid, deciduous scales, those of the lateral line tubular. Base of all fins invested by small scales. Head naked. Cleft of mouth of moderate width. Jaws nearly equal in front. A series of small teeth on intermaxillae, mandibles and palatines. Dorsal and anal rather short, their origin nearly opposite. Opercles large and thin, gillopening wide, partially covered by the entirely separate and overlapping gillmembranes and by a continuation of the skin of the head. Gillrakers numerous, close set and rather long. Pseudobranchiae present. Branchiostegals 6.

Key to the species.

a. Eyes 5—6, more than one diameter apart; gillmembranes broadly overlapping each other . . . . . *A. bicolor* p. 99.
b. Eyes $3^1/_2$, half diameter apart; gillmembranes slightly overlapping each other . . . . . *A. blanfordi* p. 100.

1. Alepocephalus bicolor Alc.

Alepocephalus bicolor Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 133. — Descript. Cat. Indian Deep Sea Fishes, 1899, p. 169.
Alepocephalus bicolor Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 19.
Alepocephalus bicolor Max Weber, Siboga-Exp. Fische 1913, p. 10.

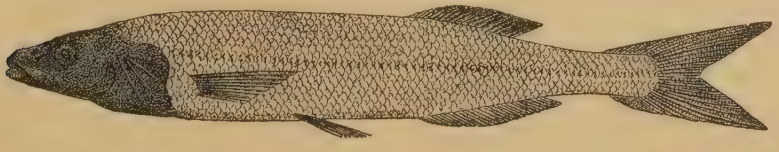

Fig. 34. *Alepocephalus bicolor* Alc.

B. 6; D. 20—21; A. 26—28; P. 10—11; V. 8; L. l. 62—63; L. tr. 18.

Height about $4^3/_4$; head about $3^1/_3$—$3^3/_4$. Eyes 5—6, converging anteriorly and more than their own diameter apart; about $1^1/_3$ in the length of the obtusely pointed, conical snout. The very large pearshaped posterior nostril contiguous to anterior orbital margin, close to posterior border of smaller anterior nostril. Cleft of the mouth slightly oblique. The rounded posterior end of the maxilla reaches just behind the vertical through anterior border of eye. Dorsal begins a little in advance of anal, its length $^2/_3$ of that of anal, both begin just in advance of posterior third of body. Pectorals about equal to postorbital part of head, reaching ventrals; the origin of the latter is between that of pectorals and anal. Caudal deeply forked, with very numerous rudimentary rays at its base. Scales large, cycloid, deciduous, least on the lateral line. A row of small teeth on intermaxillary, mandibulary and palatines. Gillrakers long and lamellar. Pseudobranchiae small. Brown, head and paired fins black. Length 300 mm.

Habitat: Flores sea (521—538 m.)!; W. of Sumatra (750 m.). — Bay of Bengal (440 m.); Arabian sea (658 m.).

2. Alepocephalus blanfordi Alc.

Alepocephalus Blanfordi Alcock, Ann. Mag. Nat. Hist. (6) x, 1892, p. 357. — Descr. Cat. Indian Deep-Sea fishes, 1899, p. 171.
Alepocephalus Blanfordi Max Weber, Siboga-Exp. Fische 1913, p. 10.

B. 6; D. 16; A. 17; P. 11; V. 6—7; L. l. ca. 70.

Height $5^1/_2$; head 3. Eyes about $3^1/_2$, half a diameter apart, about equal to depressed, obtusely pointed snout. Large nostrils close together in front of angle of eye. Mouth-cleft almost horizontal, maxilla reaching just beyond anterior border of eye. Dorsal and anal, similar in form, equal in extent and opposite, lie well within posterior third of body. Ventrals almost in middle of body, nearer to anal than to pectorals. Caudal deeply forked, with many rudimentary rays at its base. Scales thick, deciduous, cycloid. A row of fine teeth in jaws and on prominent palatines. Gillrakers broadly lanceolate, acute. Pseudobranchiae large. Body grey, head and fins black. Length 350 mm.

Habitat: Flores sea (694 M.)! — Arabian sea (1650 M.).

Bathytroctes Günther.

(Günther, Ann. Mag. Nat. Hist. II. 1878, p. 249).

Rather elongate, compressed, covered by cycloid deciduous scales of moderate size. Cleft of mouth wide. A series of small teeth on intermaxilla, maxilla, mandible, palatines and vomer. Dorsal and anal rather short. Dorsal inserted conspicuously in front of anal. Branchiostegals 7. Otherwise as Alepocephalus.

Synopsis of the species

A. Cheeks and opercles scaly, snout shorter than eye, which goes 3 times in head . . . . . *B. squamosus* p. 101.

B. Head naked.

a. snout twice longer than eye, 5—6 in head . . . . . *B. calcaratus* p. 102.

b. snout shorter than eye, which goes $3^1/_4$ times in head *B. macrolepis* p. 103.

1. Bathytroctes squamosus Alc.

Bathytroctes squamosus Alcock, Ann. Mag. Nat. Hist. 1890, p. 304. — Descript. Cat. Indian Deep Sea Fishes, 1899, p. 173.

Bathytroctes squamosus Max Weber, Siboga-Exp. Fische 1913, p. 11.

B. 7; D. 17; A. 17; p. 10; V. 9; L. l. circa 50; L. tr. 15.

Head $3^3/_4$—4 and a little more than height. Snout much shorter than eye, which is $^1/_3$ the length of the head and almost enters the dorsal profile. Nostrils large, situated immediately in front of eye. Mouth-cleft wide, approaching the transverse; intermaxillary short and slender, the broad maxilla reaches just behind level of mid-orbit and includes the mandible in repose, except anteriorly where the latter strongly projects. Small, even, acute, uniserial teeth, recurved in the intermaxillae, mandibles, palatines and vomer, procurrent or procurved in the maxillae. Dorsal begins just behind origin of ventrals, which are situated in the vertical through the middle of the body, measured without caudal. The anal begins in the vertical through the 13th dorsal ray. Caudal symmetrically forked. Pectorals long and narrow, their longest rays equal to length of head behind anterior nostril, almost touching the base of ventrals. Ventrals broad, reaching slightly beyond

vent. Scales large, deciduous, excepting the lateral line, where they are adherent and perforated; there are scales on the cheeks and opercles. Gillrakers long and close set. Colours in fresh state: head uniform deep black, body pinkish brown, fins transparent grey. Length 266 mm.

Habitat: Bali sea (1018 m.)! — Arabian sea, off the Laccadives (1353 m.); Indian Ocean off Goa coast (1332 m.).

2. Bathytroctes calcaratus M. Web.

Bathytroctes calcaratus Max Weber, Siboga-Exp. Fische 1913, p. 11.

B. 7; D. 17; A. 17; P. 13; V. 9; L. l. 55; L. tr. about 18.

Head $3^4/_5$—$4^1/_3$, naked, its profile sloping down with a slight convexity above the eyes and a conspicuous concavity of the snout; lastnamed twice longer than eye and conspicuous by its breadth in consequence of the lateral prominence of jaws. Eye high, 5 to nearly 6, $2^4/_5$—3 in snout and nearly 3 times in interorbital space, which has a deep, broad furrow. Posterior crescentic nostril, the point of which is directed downward,

Fig. 35. *Bathytroctes calcaratus* M. Web.

contiguous to orbital margin; quite close before it is the roundish anterior nostril. Gape of the mouth ascends obliquely, the lower jaw is prominent and has besides, at the symphysis, a triangular tubercle, obliquely directed anteriorly and inferiorly. The pointed posterior end of the intermaxillary is about half the length of the snout distant from the anterior border of the eye; above it, reaching far anteriorly, lies the maxillary, the rounded posterior border of which lies in the vertical through posterior margin of eye. Jaws with a row of internally curved teeth, somewhat stronger but straight ones on vomer and palatines. Base of ventrals in the middle of the interspace between snout and base of caudal, their posterior point oppo-

site to origin of dorsal. Origin of anal opposite to middle of dorsal. Pectorals equal to postorbital part of head, ventrals slightly shorter. The thin, cycloid, deciduous scales, have their hindborder irregularly rounded or somewhat pointed. Posteriorly they get smaller and are wanting on the fins. About 25 slender gillrakers on the first branchial arch. Colour nearly uniformly bluish black. Length 265 mm.

Habitat: Straits of Macassar (724 m.)! and Ceram sea (567 m.)!

3. Bathytroctes macrolepis Gthr.

Bathytroctes macrolepis Günther, Challenger, Deep-sea fishes 1887, p. 225

B. 7; D. 15; A. 11; V. 8; L. lat. 42.

Height $5^1/_2$, head a little less than 3. Head low and elongate. tapering towards the front. Eye $3^1/_4$, rather longer than pointed snout, double of interorbital space. Jaws equal; maxillary extends to below posterior third of the orbit. The dentition feeble; teeth small, pointed, of equal size, uniserial. Intermaxillary and the foremost part of the maxillary toothless; vomerine series divided into two groups, each with three teeth. Palatine series short, consisting of about nine teeth. Gillrakers long, lanceolate, rather widely set, 22 on the outer branchial arch. Vent nearly midway between gillopening and root of caudal. Origin of dorsal somewhat in advance of vent, its last ray opposite to the fourth of the anal. Both dorsal and anal rather high in front, their longest rays being equal in length to the depth of this portion of the body. Ventrals covering the vent, but not extending to the anal; their base is midway between the root of the pectoral and the end of the anal, immediately in advance of the dorsal.

Scales simple, cycloid. Lateral line straight, running along the middle of the tail, with wide mucous apertures. Colour uniform black. Length 225 mm. (without caudal). [After Günther, not seen by us].

Habitat: North of Celebes, depth 2150 fathoms (3932 m.).

4. Aleposomus Gill.

(Gill, American Natural. XVIII. 1884, p. 433).

(*Xenodermichthys* Günther).

Slender, compressed, without scales or only in the lateral line, which only in that case is conspicuous. Skin thick, especially on the head and on the belly, with small irregular papillae. Mouth small or moderate. Jaws feeble, with small teeth in the intermaxilla, maxilla and mandible. Palate toothless. Dorsal and anal nearly equal and about totally opposite. Ventrals about in the middle of the body. Radii branchiostegi 6—7. Otherwise as in Alepocephalus.

Synopsis of the species.

A. Lateral line very conspicuous, with underlying scales, eye more than double of interorbital space . . . . . *A. lividus* p. 104.

B. Lateral line inconspicuous, without scales, eye somewhat more than interorbital space . . . . . *A. nudus* p. 105.

1. Aleposomus lividus Brauer.

Aleposomus lividus Brauer, Deutsche Tiefsee-Exp., Tiefseefische 1906, p. 21.

D. 19—21; A. 18—19; P. 7—8; V. 7.

Height $4^1/_4$—$4^3/_4$, head 3—$3^1/_3$, eye 3—$3^1/_3$, more than double of interorbital space, snout $1^1/_2$—2 in eye. Gape of mouth reaching the vertical through posterior margin of eye. Intermaxilla, maxilla and mandible with small theeth. Origin of dorsal nearly at the beginning of the last $^1/_3$ of the body, in the vertical through the anus, somewhat before anal. Ventrals somewhat behind middle of body. Lateral line very conspicuous; its pores on the top of papillae which are directed backward. Scales underneath lateral line, circular in their anterior part, with very broad opening, through which goes the lateral canal; hindpart of scales handle-shaped and laterally deflected from the anterior part. Skin otherwise naked, divided in regular areas, with scattered short black papillae. Blue black with a violet hue, fins dark. Length 330 mm. [After Brauer, not seen by us].

Habitat: West of Sumatra (768—1143 m.).

2. Aleposomus nudus Brauer.

Aleposomus nudus Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 22.

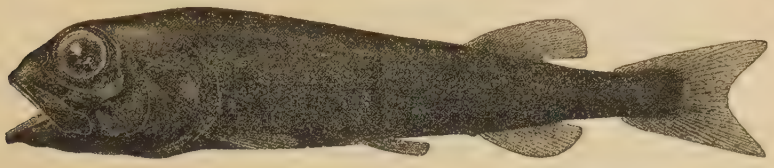

Fig. 36. *Aleposomus nudus* Brauer (after Brauer).

B. 7; D. 18; A. 17; P. 7; V. 6.

Height $4^4/_5$, head 3, eye $3^4/_5$ to rather more than 4, somewhat more than interorbital space, equal to snout. Gape of mouth nearly reaches the vertical through posterior margin of eye. Small teeth on intermaxilla, maxilla and mandible. Origin of dorsal in the vertical through anus, somewhat before anal, in the beginning of last $^1/_3$ of body. Ventrals somewhat behind middle of body. Lateral line very inconspicuous, its openings on the top of slender tubes, no scales. On head and belly small papilliform nodules, irregularly arranged. Velvety black with a bluish hue. Length 125 mm. [After Brauer, not seen by us].

Habitat: West of Sumatra (750 m.).

8. Fam. Stomiatidae.

Elongate, or short and elevated, compressed, mostly with scales, which are cycloid and generally very deciduous. A mandibulary barbel present or absent. Gape of mouth wide, bodered by the short intermaxillary and the long maxillary. Dorsal before or behind ventrals. Adipose fin, if present, above or behind anal, which is situated behind the middle of the length of the body. Pectorals, if present, low down. Caudal forked. Close set teeth, serially or in bands, in jaws, some of the anterior ones may be fangs. If present, various in form and arrangement on vomer, palatines, pterygoids and tongue. Ventrals abdominal, with 5—8 rays. Gillopening wide, gillmembranes not connected or only at their base, generally free from isthmus. Branchiostegals 8—20. Pseudobranchiae present or absent. Four gills. Airbladder, if present, not contiguous

with auditory organ. Gillrakers moderate, short or wanting. Luminous organs (photophores) on head and body.

Synopsis of the subfamilies.

A. Luminous organs separate, not united in groups. Body very low and elongate. No pseudobranchiae. Gillrakers short or wanting . . . . . *Stomiatinae* p. 106.

B. Luminous organs in groups. Body generally short and elevated. Pseudobranchiae present or absent. Gillrakers well developed (always?) . . . . . *Sternoptychinae* p. 128.

1. Subfam. Stomiatinae.

Body very low, elongate and compressed. A mandibulary barbel present or absent. Eye generally large. Gape of mouth very wide, oblique. Dorsal generally short or by exception long, its origin before or behind ventrals. Adipose fin, if present, above or behind anal. Pectorals may be absent, if present, very low down. A praeanal adipose fin may be present. Ventrals well developed or even long. Caudal forked, its lobes often unequal. Scales, if present, very thin, deciduous, cycloid and sometimes rhombic. Minute teeth in jaws, those of the intermaxilla and mandible may be all or in part enlarged and even fang-like; on palate present or absent. Luminous organs always separate. There may be opercular luminous organs and others before, below and behind eye, the lastnamed even revolving. Some between the branchiostegal rays. On the body a complete ventral series between isthmus and caudal and a more lateral one reaching not so far. Scattered between them and on the body there may be smaller luminous organs as well as whitish punctiform organs on the fins. Branchiostegal rays 8—20. Gillmembranes free from isthmus. Gillrakers well developed, short or wanting. Gills 4. No pseudobranchiae.

Artifical key to the genera.

I. No pectorals. Origin of long dorsal far in advance of anal, its end above anal. No adipose fin . . . . . *Idiacanthus* p. 107.

II. Pectorals present.

A. Dorsal between pectorals and ventrals. Barbel rudimentary. Adipose fin present . . . . . *Chauliodus* p. 109.

B. Dorsal behind ventrals.

1. Barbel present.

a. No adipose fin. Origin of dorsal and anal opposite.

aa. Scaly, teeth fixed . . . . . *Stomias* p. 111.

bb. Scaleless, teeth depressible . . . . . *Melanostomias* p. 113.

b. Adipose fin present. Dorsal between ventrals and anal . . . . . *Astronesthes* p. 115.

2. No barbel.

a. Dorsal as long as anal and opposed to it, its end close to caudal. Vomer and palatines without teeth. Suborbital luminous organ crescentic and revolving . . . . . *Malacosteus* p. 117.

b. Dorsal much shorter than anal, its end far distant from caudal. Teeth on palatines, on vomer present or absent. Suborbital luminous organ not revolving, black.

α. Origin of dorsal in middle of length, situated before anal. Teeth on palatines . *Vinciguerria* p. 119.

β. Origin of dorsal behind middle of length, opposite to anal.

aa. Suborbital bone dilated, covering, at least partly, the cheek. Long fang-like teeth rather regularly distributed in the upper and lower jaw, with much smaller ones between them. Adipose fin present *Gonostoma* p. 120.

bb. Suborbital bone not dilated, not covering the cheek. Teeth in jaws small, increasing in size from before backward, the posterior maxillary ones more or less obliquely directed forward, sometimes a few short fangs anteriorly in the mandible. No adipose fin . . . . . *Cyclothone* p. 124.

1. Idiacanthus Peters.

(Peters, Monatsberichte Akad. Berlin 1876, p. 847).

Very slender, elongate and compressed. Scaleless. Head compressed, small. Snout short. Opercle narrow. Gape of mouth and gillopening very wide. A long fleshy barbel behind the chin. No pectorals. Ventrals before middle of body. No adipose fin. Origin of the very long dorsal above or before ventrals. Vent on a papilla behind middle of body, immedia-

tely behind it the long anal. On each side of the base of the dorsal and anal, between two following rays, a short, curved, spine-like process, belonging to the ray in front of it, from the base of which it develops. Most rays of dorsal and anal simple. Teeth in intermaxilla and mandible large, quadrangular, bicuspid, depressible, arranged in groups, increasing in each group in size from forward to backward, those in the maxilla small, close-set. A few teeth on vomer, palatines and tongue. A postorbital revolving luminous organ. On each side a ventral series of fixed organs, from isthmus to caudal; a lateral series from gillopening to middle of anal, besides numerous ones scattered on head and body. Four gills. No pseudobranchiae, nor gillrakers. Branchiostegal rays numerous.

1. Idiacanthus fasciola Ptrs.

Idiacanthus fasciola Peters, Monatsber. Akad. Berlin, 1876, p. 847.
Idiacanthus fasciola Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 60.
Idiacanthus fasciola Max Weber, Siboga-Exp. Fische 1913, p. 15.

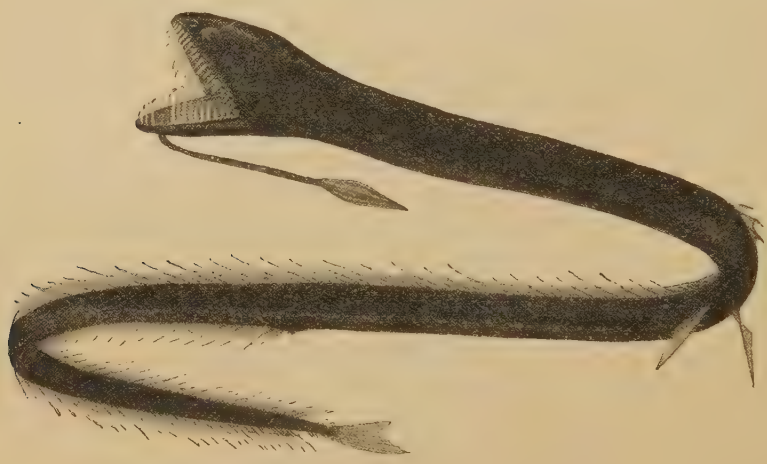

Fig. 37. *Idiacanthus fasciola* Ptrs. (after Brauer).

B. 15—16; D. 63—67; A. 40—45; V. 6.

Height 40—45, head more than 14, eye about $5^1/_2$ or more. Snout equal to eye or shorter, on the interorbital space two diverging crests. Barbel twice as long as head. Origin of dorsal nearer to ventrals than to posterior margin of head. Ventrals shorter than head. Intermaxillary with 13—15 unequal teeth,

in 4 groups, increasing in size posteriorly. Maxilla with a few small pointed teeth. Mandible with 12 unequally large teeth in 3 groups, behind them 3 or 4 smaller ones. 2 fangs on vomer and smaller teeth on palatines and tongue. Luminous organs: an inconspicuous suborbital and a revolving small postorbital one; 15—16 between branchiostegal rays, a few on opercle; 33—35 in the ventral series from isthmus to ventrals, 16—17 between ventrals and anal, 32 between anal and caudal. In the lateral series 22—24 from gillopening to vertical through ventrals, 16 from here to anal, behind anal 12. Velvety black. Fins translucent. Iris black. Barbel black, with a subterminal white ring. Length 180 mm.

Habitat: Halmahera Sea (1600 m.)!; between Australia and Sumba (surface); North of Geelvink bay, New Guinea (surface); West of Sumatra (594 m.). — Indic, between Chagos Archipelago and Seychelles.

2. **Chauliodus** Bloch, Schneider.

(Bloch, Schneider, Systema Ichthyolog. 1801, p. 430).

Elongate, strongly compressed, covered with very thin, deciduous, hexagonal scales. Head much compressed, elevated and short. Gape of mouth oblique, very wide as also the gillopening. Opercle short. Interopercle rudimentary. Chin with a rudimentary barbel. Pectorals moderate, ventrals long, situated in the second $^1/_3$ of the length. Short dorsal before ventrals, its first ray produced in a long filament, reversible in frontal direction. Short adipose fin opposite to anal. Caudal forked. Vent near anal. A praeanal adipose fin. Large intermaxillae with four enormous fangs on each side, mandibles with 4—5 excessively long ones, besides a few moderate teeth. None of the large teeth are received within the mouth. Maxillae with numerous close-set small teeth. Palate with a single series of small teeth. Tongue edentulous. A small suborbital luminous organ. Luminous organs between the branchiostegal rays. On each side a ventral series of luminous organs from isthmus to caudal, slightly above it a second series from gillopening to anus, besides numerous small ones scattered between them. Branchiostegals numerous. No pseudobranchiae, nor gillrakers.

Synopsis of the species.

I. 23—26 luminous organs between ventrals and anal . . *Ch. sloani* p. 110.
II. 20—21 luminous organs between ventrals and anal . . *Ch. pammelas* p. 110.

1. Chauliodus sloani Bl. Schn.

Chauliodus sloani Bloch, Schneider, Syst. Ichth. 1801, p. 430.
Chauliodus sloanii Alcock, Descript. Catal. Indian Deep-sea Fishes 1899, p. 144.
Chauliodus sloanei Brauer, Tiefseefische 1906, p. 40, (see syn.).
Chauliodus sloanei Zugmayer, Camp. Sc. Monaco, XXXV. Poissons, 1911, p. 63.
Chauliodus sloani Max Weber, Siboga-Exp. Fische 1913, p. 12.

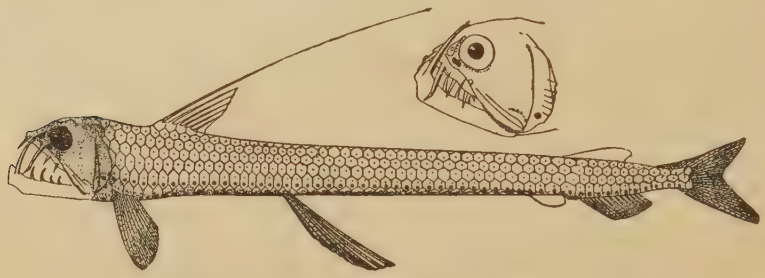

Fig. 38. *Chauliodus sloani* Bl. Schn.

B. 16—20; D. 6; A. 12; P. 12—14; V. 7; L. l. 56—61.

Height 7—8, head 6—$7^4/_5$. Eye about $3^1/_2$ (♂), $4^2/_5$—$4^3/_4$ (♀), accordingly the snout is equal to or twice the eye. Double orbital organ below the eye, exteriorly conspicuous as a black spot. Suborbital large organ revolving, near border of jaw. A series of small organs on the superior and inferior orbital margin, besides other ones on upper jaw and base of barbel. 19—21 luminous organs between isthmus and pectorals, 23—26 between ventrals and anal, 10—11 between anal and caudal. Length 235 mm.

Habitat: Flores sea (1600 m.)!; Banda sea (2000 m.)!; Timor sea (421 m.)!; West of Sumatra (594 m.). — Circumtropical, bathypelagic.

2. Chauliodus pammelas Alc.

Chauliodus pammelas Alcock, Ann. Mag. Nat. Hist. 1892, p. 355.
Chauliodus pammelas Alcock, Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 145.
Chauliodus pammelas Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 42.
Chauliodus pammelas Max Weber, Siboga-Exp. Fische, 1913, p. 13.

Differs from *Ch. sloani* only in that there are only 20—21 luminous organs between ventrals and anal. Length 250 mm. Seems to us to be a doubtful species.

Habitat: Flores sea (538 m.)!. — Indic.

3. Stomias Cuvier.

(Cuvier, Règne animal, II. 1817, p. 184).

Elongate, strongly compressed, covered by very thin, deciduous, hexagonal scales. Head compressed, snout very short, gape of mouth oblique and extremely wide, as also the gill-opening. Lower jaw prominent, mandibles widely distensible. Opercle narrow. Interopercle rudimentary. Chin with a fleshy barbel, ending in three filaments. Pectorals and ventrals rather narrow, the latter in the last $^1/_3$ of the length. Origin of dorsal above anal. No adipose fin. Ventral lobe of caudal generally longer than the dorsal. Vent on a papilla just before the anal. Teeth fixed, in maxilla numerous, small and approximate, those in the intermaxilla and mandible more or less curved; large and wide apart. Vomer with a pair of fangs, palatines and tongue with smaller pointed teeth. Head with a large suborbital photophore. Luminous organs between branchiostegal rays. On each side a ventral series of luminous organs from isthmus to caudal, above it a lateral series from gill-opening to anus, besides numerous smaller organs scattered between them. Four gills. No pseudobranchiae, nor gillrakers.

We draw attention to the following figure (39) of a larva of *Stomias*, from the Molucco-passage (1500 m.), distinguished by its pellucidity, so that the myomeres can be counted, and by the exceedingly long anal papil. It has D. 17; A. 21. (see Siboga-Exp. Fische, p. 14).

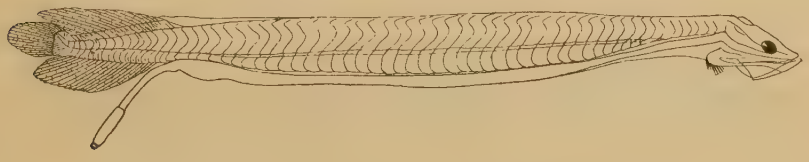

Fig. 39. *Larva* of *Stomias* × 4.4.

Synopsis of the species.

I. Intermaxillary teeth 4—6, longer than the mandibulary teeth, which are few in number (about 8). 43—46 luminous organs between pectorals and ventrals . . . . . *S. valdiviae* p. 112.

II. Intermaxillary teeth about 25, smaller than the circa 13 large mandibulary teeth. 34—38 luminous organs between pectorals and ventrals . . . . . *S. nebulosus* p. 112.

1. Stomias valdiviae Br.

Stomias valdiviae Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 48.

B. 17; D. 18—19; A. 21—22; P. 6; V. 5; L. l. 67—70.

Height 10—12, head 9—10. Eye $3^1/_2$ (♂), $4^4/_5$ (♀), snout equal to eye or longer. Barbel about as long as head. Origin of dorsal slightly behind origin of anal. Ventrals reaching on anal. Ventral lobe of caudal longer than dorsal one. 5—6 large distant teeth in the intermaxilla, the second of which is a large fang. They are longer than the few (about 8) in the mandible, the 4 anterior of which are small. Suborbital organ conspicuous, 17 luminous organs between branchiostegal rays. In the ventral series of luminous organs 10—11 between isthmus and pectorals, 43—46 between pectorals and ventrals, 5—6 between ventrals and anal, 16—17 between anal and caudal. Black, scales with metallic gloss, fins white with black tips. Pectorals totally white. Length 122 mm. [After Brauer, not seen by us].

Habitat: West of Sumatra (594 m.). — Indic near Sokotra (2000 m.); Atlantic (600—2200 m.).

2. Stomias nebulosus Alc.

Stomias nebulosus Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 451.
Stomias nebulosus Alcock, Descriptive Catalogue Ind. Deep-sea Fishes, 1899, p. 146.
Stomias nebulosus Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 50.
Stomias nebulosus Max Weber, Siboga-Exp. Fische, 1913, p. 13.

Fig. 40. *Stomias nebulosus* Alc.

B. 16—17; D. 16—17; A. 21; P. 6; V. 5; L. l. circa 62.

Height about 10, head 8—9. Eye slightly more than 4. In the male the eye is larger than in the female. Snout shorter

than eye. Barbel nearly as long as head. Origin of dorsal a little behind origin of anal, which is higher than dorsal. Ventrals prolonged, reaching on anal. Pectorals near ventral profile, equal to height of body. About 25 unequal and curved teeth in each intermaxilla, the first and fifth the largest, but smaller than the large of the circa 13 teeth in each mandible; those on the maxilla about 30, minute, close-set, directed backward. Suborbital organ very small. 16—17 luminous organs between branchiostegal rays. The ventral series of luminous organs between isthmus and pectorals consists of 6, between pectorals and ventrals of 34—38, from ventral to anal of 6, from anal to caudal of 16—17 organs. Uniform black with metallic gloss. Fins and barbel white, the last with black tip. Length 135 mm.

Habitat: Flores sea (521 M.)!; Timor sea (421 M.)!; Manipa-straits (1536 M.)!. — Indik (Gulf of Manaar 1093 M.); East coast of Africa 693—1119 M.

4. **Melanostomias** Brauer.

(Brauer, Zool. Anzeiger XXV. 1902, p. 284).

Elongate, strongly compressed, tapering posteriorly, scaleless. Gape of mouth extensive as also the gillopening. Opercle little developed. Chin with a well developed barbel. Pectorals short, ventrals long, far behind middle of body. Dorsal opposite to anal and shorter than that fin. No adipose fin. Caudal short, forked. Vent near anal. Intermaxilla and mandible with large bicuspid depressible teeth. Maxilla anteriorly with some large teeth, posteriorly with numerous small ones, directed backward. Teeth on vomer and palatines, and sometimes on tongue. Behind the eye is a large revolving postorbital luminous organ, an inconspicuous organ below the eye and one on the opercle. 12 organs between the branchiostegal rays, besides numerous small ones round the eye, on the jaws and scattered on the head. On each side a ventral series of organs beginning behind the isthmus and running to the caudal, a lateral series from gillopening to anal. Numerous small organs and whitish punctiform ones in groups ventrally of each larger organ of a longitudinal series, and in transverse rows on the body. 4 gills. No pseudobranchiae. 11—12 branchiostegals. [after Brauer].

Synopsis of the species.

I. Barbel 3 times longer than head. Tongue with teeth. 31 luminous organs in the ventral series between pectorals and ventrals, 28 in the lateral series from gillopening to vertical through ventrals. . . . . *M. melanops* p. 114.

II. Barbel shorter than head. Tongue without teeth. 27 luminous organs in the ventral series between pectorals and ventrals, 24 in the lateral series from gillopening to vertical through ventrals. . . . . *M. valdiviae* p. 115.

1. Melanostomias melanops Brauer.

Melanostomias melanops Brauer, Zool. Anz. XXV. 1902, p. 284. — Deutsche Tiefsee-Exp. Tiefseefische 1906. p. 53.

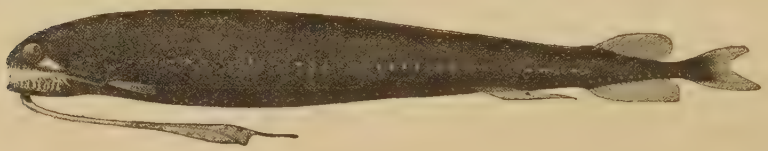

Fig. 41. *Melanostomias melanops* Brauer (after Brauer).

B. 12; D. 14; A. 17; P. 5; V. 8.

Height 7, head nearly 7; diameter of eye $5^1/_2$, slightly more than length of snout. Barbel 3 times as long as head, thick, its distal part lamellated, ending in a thin filament. Pectorals shorter than half head, ventrals nearly at the beginning of the last $^1/_3$ of the body, longer than head, reaching to anus. 8 intermaxillary teeth, the first and third small, the other ones longer, the fifth the largest. A group of 5 teeth in the maxilla, equal to the large intermaxillary teeth, behind them about 24 small close-set teeth, directed backward. 11 mandibulary teeth, the first two and the fourth small, the third the largest, the rest in two groups, in which the height increases posteriorly. All large teeth bicuspid and depressible. Vomer with one pair of teeth, palatines with 4, tongue with two teeth. The ventral series of luminous organs consists of 8 near isthmus, 31 from pectorals to ventrals, 11 from ventrals to anal, 12 from there to caudal. In the lateral series 28 from gillopening to vertical through ventrals, 12 from here to vertical through anal. Velvety black. Eye black. Base

of barbel black, otherwise yellowish grey. Fins white with black spots. Length 183 mm. [After Brauer. Not seen by us].

Habitat: N. W. coast of Sumatra (1024 M.).

2. Melanostomias valdiviae Brauer.

Melanostomias Valdiviae Brauer, Zool. Anz. XXV. 1902, p. 285. — Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 56.
Melanostomias valdivae T. Regan, Trans. Linn. Soc. London XII (3), 1908, p. 218.

B. 11—12; D. 13; A. 18; P. 5; V 6.

Height $7^{3}/_{10}$, head $7^{1}/_{2}$, eye $5^{1}/_{2}$, snout much shorter. Barbel shorter than head, terminating in 3 unequal intumescencies and filaments. Ventrals situated at the end of the second $^{1}/_{3}$ of the body. 7 intermaxillary teeth, the fourth and fifth the largest. 9 mandibulary teeth, the second the largest. Maxilla anteriorly with 5 teeth, increasing in size posteriorly, equal to intermaxillary teeth; behind them a series of 10 in a young specimen (Regan), or 28 in a large specimen (Brauer), of small close-set teeth, directed backward. Except the lastnamed, all teeth bicuspid and depressible. Tongue without teeth, palatines with 3 teeth. Arrangement of luminous organs essentially the same as in *M. melanops*, except that the ventral series contains 27 organs between pectorals and ventrals, 11 between ventrals and anal, 13 between anal and caudal, and that the lateral series from gillopening to vertical through ventrals contains 24, and from here to vertical through anal 13. Colour as in *M. melanops*, but the barbel entirely bluish black. Length 165 mm. [Not seen by us].

Habitat: West of Sumatra (614 M.). — Indic near Farquhar atoll (914—1371 M.).

5. Astronesthes Richardson.

(Richardson, Zoology Voyage Sulphur, Ichthyol. 1844—1845, p. 97).

Elongate, strongly compressed, scaleless. Head compressed, snout short, lower jaw prominent, gape of mouth wide. Chin with a long, fleshy barbel. Pectorals and ventrals long and narrow, ventrals near middle of body, opposite to dorsal or shortly before it. Adipose fin opposite to anal. A ventral adipose fin before vent. Caudal forked. Teeth in the intermaxilla and mandible widely set, unequal, some of them long,

curved canines, those of the maxilla subequal, much smaller, closely set and directed backward. Vomer generally edentulous. Palatines and tongue with a series of small pointed teeth. Luminous organs: a large postorbital organ and smaller ones on the opercle and between the branchiostegal rays; on each side of the body a ventral series from isthmus to caudal, and a more lateral series from gillopening to anal. Numerous small organs between the longitudinal series and scattered over the body. Four gills. No pseudobranchiae. Gillrakers minute.

Synopsis of the species.

I. 38 luminous organs in the lateral series. Eye more than $5^1/_2$, shorter than snout. . . . . *A. lucifer* p. 116.

II. Circa 50 luminous organs in the lateral series. Eye circa 3, about twice as long as snout. . . . *A. chrysophekadion* p. 117.

1. Astronesthes lucifer Gilb.

Astronesthes lucifer Gilbert, Bull. U. S. Fish. Comm. XXIII. 2. 1903 (1905), p. 605
Astronesthes lucifer Max Weber, Siboga-Exp. Fische, 1915, p. 13.

Fig. 42. *Astronesthes lucifer* Gilb.

D. 11; A. 19; P. 6; V. 7.

Height about 6, head $4^1/_5$—$4^1/_2$, eye more than $5^1/_2$, shorter than snout. Barbel shorter than gape of mouth or longer than head (Gilbert), with a dilated tip. Pectorals about $1^1/_2$ in length of head. Ventrals about midway between anal and praeopercle. Dorsal somewhat behind insertion of ventrals, shorter but much higher than anal. Intermaxilla with 5—6 unequally placed unequal teeth, sometimes with a substitute behind them. Maxilla with 11—13 (15—20 in the larger specimen of Gilbert) subequal, pointed teeth, directed backward. Mandible with 6—8 unequal teeth, the posterior placed unequally and somewhat alternating, some of them with a substitute; most of the intermaxillary and mandibulary teeth

are slender canines and arrow-shaped at tip. 12 luminous organs in ventral series between isthmus and pectorals, 18 between pectorals and ventrals, 22 between ventrals and anal. 10 above anal, the last 2 are smaller and situated higher upward, 4 behind anal. 38 organs in the lateral series. Sides of head and body greyish silvery, brownish above and below. Fins translucent. Length 75 mm.

Habitat: Timor sea (421 M.)!. — Pacific near Hawaian islands (470—2232 M.).

2. Astronesthes chrysophekadion (Blkr.).

Stomianodon chrysophekadion Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Ichth. Bali, p. 10.
Astronesthes chrysophekadion Bleeker, Atl. Ichth. VI. livr. 27. 1875, p. 150.

B. 14; D. 12; A. 20; P. 6; V. 7.

Height 8—9, head about 5, eye about 3, about twice as long as snout. Barbel a little shorter than head. Pectorals and ventrals about half of head, the last scarcely nearer to anal than to head. Origin of dorsal somewhat behind insertion of ventrals, a little shorter but higher than anal. 6 unequally long, arrow-shaped teeth in intermaxilla, the 2 anterior very long and curved. Maxilla with about 20 subequal small, close-set teeth. Mandible with 10—12 long curved unequal teeth, the anterior ones the longer and arrow-shaped. About 50 luminous organs in the lateral series. Blackish or brown, opercle and sides lighter. Length of single specimen known 115 mm. [After Bleeker; not seen by us].

Habitat: Bali.

6. Malacosteus Ayres.

(Ayres, Journ. Boston Soc. Nat. Hist. 1849, p. 53).

Elongate, compressed, tapering behind head, scaleless. Head compressed, snout very short. Gape of mouth extremely wide. Jaws extending beyond the root of the pectorals. Opercle very narrow and membranaceous. No barbel at chin. Pectorals rather long and narrow (or rudimentary?). Ventrals behind middle of body. Dorsal and anal opposite and nearly equal, at no great distance from the caudal. Unequal, pointed teeth in a single series in both jaws and in pairs on the tongue.

All teeth bicuspid. A crescentic suborbital and a smaller postorbital luminous organ, revolving and covered by translucent skin, besides an orbital one, covered by the skin. On each side of the body a ventral and a lateral series of organs, partly covered by the skin, besides smaller organs scattered over head and body. 4 gills. No gillrakers. Branchiostegals 8.

1. Malacosteus indicus Gthr.

Malacosteus indicus Günther, Ann. Mag. Nat. Hist. II. 1878, p. 181. — Challenger Rep. Deep-Sea Fishes, 1887, p. 214.
Malacosteus spec. Alcock, Descript. Catal. Indian Deep Sea Fishes, 1899, p. 149.
Malacosteus indicus Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 65.

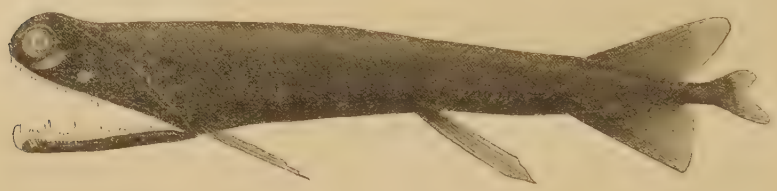

Fig. 43. *Malacosteus indicus* Gthr. (after Brauer).

D. 16—18; A. 18—20; P. 2—3; V. 6.

Height almost $5^3/_4$, head $3^4/_5$—4. Eye oval, about 4. Snout less than $^1/_3$ of eye. Origin of ventrals about an eye length behind middle of body. Anal and dorsal in the last $^1/_3$ of body, arising nearly in the same vertical. Teeth in the intermaxilla small, in 4 widely set groups. First group with one, second with 3, third with 9, fourth with 8 teeth. About 20 minute teeth in the maxilla. The largest of the teeth in the mandible is a strongly curved fang near the symphysis. It is followed at some distance by a smaller fang, situated outside the series of teeth, which are arranged in five groups. The first has six teeth, of which the last is by far the largest. The second group has 4—6 moderate-sized and some smaller teeth, of which the last is the largest. The hindermost 3 groups contain about 6 or more teeth in each group. Luminous organs as in the genus. Velvety black, distal $^1/_3$ of dorsal and anal translucent, otherwise blackish. Length 112 mm. [Not seen by us].

Habitat: Celebes sea, South of Philippines (914 M.). — Indic: North of Cocos islands (2400 M.); Andamans (1193 M.);

Bay of Bengal (2500 M.); near Chagos islands (1900 M.). Atlantic: Westcoast of South Africa (2000 M.).

7. Vinciguerria Jordan & Evermann.

(Jordan & Evermann, Fishes of North & Middle America I 1896, p. 577).

Elongate, compressed. Scales thin, cycloid. Besides those on the head there are on each side 2 rows of pearlike luminous organs, a ventral one running from the isthmus to the caudal, a more lateral one between operculum and vertical through anus. Head compressed, conical. Snout pointed, gape of mouth wide, bordered by the intermaxillary and by the maxillary, which is ventrally curved and reaches with its dilated posterior end slightly behind the eye, which is large. Lower jaw enclosed within the maxillaries. Its symphysial and posterior inferior angle prominent. Dorsal short, beginning nearly in the middle of the length; the origin of the short anal is opposite to its posterior part. The short adipose fin behind the vertical through end of anal. Caudal forked, pectorals inserted low down. Origin of ventrals before dorsal. A series of small unequal teeth in the jaws, slightly increasing in size backward. On the palatines a series from 4—5 teeth. Gillmembranes not united, free from isthmus. Gillopenings wide, gillrakers well developed.

Bathypelagic fishes.

1. Vinciguerria lucetia (Garm.).

Maurolicus lucetius Garman, Albatross Exp. XXVI. Fishes, 1899, p. 242.
Vinciguerria lucetia Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 97.
Vinciguerria lucetia Zugmayer, Campagnes Scient. Monaco, XXXV. 1911, p. 56.
Vinciguerria lucetia Max Weber, Siboga-Exp. Fische 1913, p. 21.

B. 9—11; D. 13—14; A. 14—15; P. 8—9; V. 7.

Height 5—8, head $3^1/_5$—$4^1/_5$, eye oval $3^1/_3$—$3^1/_2$, equal to the pointed snout, twice as long as the slightly concave interorbital space. Gape of mouth wide. Upper jaw ventrally rounded, posteriorly dilated, surpassing posterior border of eye. Lower jaw with a prominent symphysial angle, its inferior posterior angle prominent, enclosed between the maxillaries. Origin of dorsal in middle of length or slightly before it, its 8th ray above about the origin of anal, which is situated at

the beginning of the last third of the length. Short adipose fin slightly behind the vertical through end of anal. Pectorals far below middle of height, below posterior part of operculum, not reaching the ventrals, which originate before the middle of the body and before the dorsal and do not reach the anal.

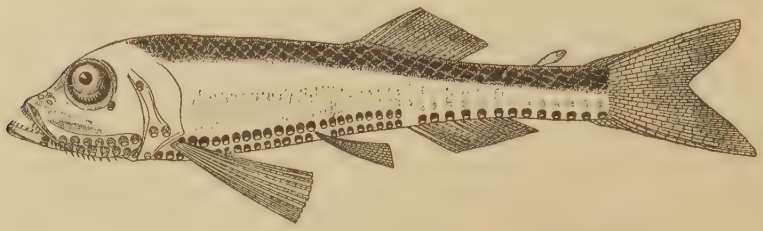

Fig. 44. *Vinciguerria lucetia* (Garm.) (After Zugmayer).

Caudal long, deeply forked. Anus slightly before anal. In the jaws a series of small unequal teeth, slightly increasing in size before backward. 4—5 in a series on the palatines, scales thin, cycloid. Luminous organs: 2 suborbital organs, an anterior entirely black one, below the interspace between nostril and eye, the other below the backportion of the orbit. 3 opercular, 2 above each other at the praeopercular margin: a posterior behind the lower anterior, one on each side behind the symphysis, 8—9 between branchiostegal rays. A ventral series of 21—23 between isthmus and ventrals, of 8—10 between ventrals and anal and of 12—13 between origin of anal and caudal of which the 6 or 7 posterior are situated behind the anal. In the lateral series 11—13 between operculum and the vertical through the ventrals, from here to the vertical through origin of anal 5—9. Blackish above, sides of head and body silvery. A black spot at the end of the tail and some short black transverse stripes on back. Length 50 mm.

Habitat: Molucco Passage (1500 M.)!. — Indic to New Amsterdam. Pacific, West coast of Mexico and Central America. Atlantic: Gulf of Guinea.

8. **Gonostoma** Rafinesque

(Rafinesque, Ind. Ittiol. Sicil. 1810, p. 64).

Elongate, compressed. Scales none or large but excessively thin, more or less concealed by the skin and only slightly evident. Eye about equal to snout. A complete ventral and

an incomplete lateral series of luminous organs, besides 2 opercular ones, a series between the branchiostegal rays and a suborbital one. Head compressed, conical. Gape of mouth very wide, bordered superiorly by the small intermaxillary and the very long, slender, sickle-shaped maxillary. Infraorbital bone dilated, covering at least a considerable part of the cheek. Lower jaw projecting, with a prominent inferior posterior angle, enclosed between the maxillaries. Dorsal shorter than anal, the origin of both opposite or nearly so, both situated behind the middle. Pectorals in the lower half of the height. Ventrals before middle of length. Caudal forked. Adipose fin nearly always present. Long, fanglike teeth, rather regularly distributed in the upper and lower jaw, with much smaller ones in the spaces between them. Vomer with or without teeth. A series of teeth on palatines and pterygoids. Gillopening very wide. Gillmembranes free from isthmus. Pseudobranchiae none. Gillrakers very long and slender. Branchiostegal rays short, 11–14.

Bathypelagic fishes.

Synopsis of the species.

1. Extremely thin, partly concealed, large scales, 2 hooked vomerine teeth. Origin of dorsal above the 2nd or 3rd anal ray. . . . . *G. rhodadenia* p. 121.
2. No scales. Vomer edentulous. Origin of dorsal and anal in the same vertical. . . . . *G. elongatum* p. 122.

1. Gonostoma rhodadenia (Gilbert).

Cyclothone rhodadenia Gilbert, Bull. U. S. Fish. Comm. XXIII. 2. (1903) 1905, p. 602.
Gonostoma rhodadenia Max Weber, Siboga-Exp. Fische, 1913, p. 18.

B. 11; D. 14; A. 30—31; P. 11—13; V. 8.

Height about 7, head about $4^1/_2$, eye 6—$7^3/_5$, $^2/_3$ of length of snout and of the interorbital space, which contains a pair of narrow ridges, lengthwise parallel, which fork anteriorly, the branches diverging to either side of nostrils, posteriorly, these ridges extend along the sides of the occiput where they gently diverge. Suborbital bone covering much less than half cheek, forming a sheet overlaying upper portion of maxillary for its entire length. Pointed symphysis of mandible very prominent. Gape of mouth very wide. Maxillary curved, reaching to angle

of praeoperculum. Dorsal opposite to anterior third of anal which reaches far beyond vertical through adipose fin and ends near forked caudal. The origin of dorsal opposite to second or third ray of anal, the origin of which is slightly behind middle of length. Origin of ventrals well before middle of length. Anus shortly before anal. Some excessively thin scales and wholly concealed beneath the skin are evident in some places in connection with the luminous organs. Intermaxilla with about 2—3, maxilla with about 12 large curved teeth, the interspaces between them filled by uniformly short teeth. Mandible with about 10—12 large, curved teeth, with smaller in the interspaces. Vomer with a pair of teeth hooked backward, those on the palatines and pterygoids in a single series, the 2 or 3 anterior enlarged, the posterior gradually smaller. Luminous organs, a black suborbital, posteriorly connected with a whitish oblong glandular patch. Two operculars, a dorsal one on the level of eye, connected with a small oblong glandular patch, an indistinct one behind edge of maxillary, one on each side behind the symphysis, 9 between the branchiostegal rays. In the ventral series 4 in advance of the pectorals, the 2 opposite series strongly converging forward, 11 between pectorals and ventrals, 5 between ventrals and anal, the anus situated between the fourth and fifth; 23 between origin of anal and caudal, the 4 hindermost behind anal. Third organ of the anal series outside the series, above the interspace between the second and fourth. 13—14 in the lateral series between operculum and vertical through origin of anal, the anterior one outside the series, far above the pectorals, ventrally 2 glandular patches behind each other above the anterior caudal rays; dorsally above them a similar organ. Brownish black above, jet-black below. Vertical fins with dark spots, usually arranged in cross lines. Length over 190 mm.

Habitat: Ceram Sea (1914 M.)!. — Hawaian Islands (748—1006 M.).

2. Gonostoma elongatum Günther.

Gonostoma elongatum Günther, Ann. Mag. Nat. Hist. (5). II. 1878, p. 187. — Challenger Rep. Deep-sea Fishes, 1887, p. 173.
Sigmops stigmaticus Gill, Proc. U. S. Nat. Mus. VI. 1883, p. 256.

Gonostoma elongatum Alcock, Ann. Mag. Nat. Hist. (6). VIII. 1891, p. 127, — Descript. Cat. Indian Deep-sea Fishes, 1899, p. 139.
Cyclothone elongata Goode & Bean, Oceanic Ichthyology, 1895, p. 101.
Cyclothone elongata Jordan & Evermann, Fishes of North & Middle America, I. 1896, p. 583.
Gonostoma elongatum Brauer, Deutsche Tiefsee Exp. Tiefseefische, 1906, p. 75.
Gonostoma elongatum Max Weber, Siboga-Exp. Fische, 1913, p. 17.

Fig. 45. *Gonostoma elongatum* Gthr. (after Brauer).

B. 14; D. 13; A. 27—30; P. 11—13; V. 7—8.

Height about 7, head $4^1/_2$ or more, eye 6—8, equal to snout or somewhat shorter and less than interorbital space. Nostrils nearer to eye than to point of snout. Suborbital bone broad, dilated, covering about anterior half of cheek. Gape of mouth exceedingly wide. Intermaxillary reaching to vertical through anterior border of eye. Maxillary curved, extending to angle of praeoperculum. Lower jaw prominent with a pointed symphysis. Origin of short dorsal and long anal opposed, behind middle of body and slightly behind anus, before the beginning of the last $^1/_3$ of the length. Anal ending behind adipose fin, near forked caudal. Ventrals before middle of body, not reaching the anal. Pectorals short, not extending to ventrals. No scales. Intermaxilla with 2—4, maxilla with 12—15 curved larger teeth, the two hindermost directed sowewhat backward, the spaces between them filled with smaller teeth. Mandible with about 10 large, slightly curved teeth, numerous smaller ones between them. Vomer edentulous. Palatines with a series of 3—5 teeth. Luminous organs: a black suborbital organ, ventrally connected with a yellowish organ obliquely directed backward. One dorsally at the hindborder of the praeoperculum, ventrally connected with a long yellow glandular patch. One behind the end of the maxilla; an inconspicuous one on each side behind the symphysis, 9 between the branchiostegal rays. A ventral series of 4 between isthmus and pectorals, 10—11 between pectorals and ventrals, 5 be-

tween ventrals and anal, 21 between origin of ventrals and caudal, the third of which is situated higher up outside the series 13 in a lateral series between operculum and vertical through anal, the anterior outside the series far above the pectorals. Ventrally on each side above the anterior caudal rays 2 glandular patches behind each other. Dorsally above them a similar organ. Black with a broad silvery, lateral band. Fins translucent. Length about 190 mm.

Habitat: West of Sumatra (614 and 677 M.); Flores Sea (1600 M.)!; Banda Sea (2477 M.! and 658 M. Challenger); Arafura Sea (1463 M.). — Indic: Arabian Sea. Atlantic: East Coast of North and Central America, Gulf of Guinea.

9. **Cyclothone** Goode & Bean.

(Goode & Bean, Bull. Mus. Comp. Zool. X. 1883, p. 221).

Elongate, somewhat compressed. Scales none or large, but very thin and deciduous, often only distinguishable by a faint marking of the skin. A complete ventral and an incomplete lateral series of small luminous organs, besides two opercular ones; a series between the branchiostegal rays and a suborbital one. Head compressed, conical. Eye very small, much smaller than snout. Gape of mouth very wide, bordered superiorly by the small intermaxillary and the very long, slender, sickle-shaped maxillary, which is more or less dilated posteriorly. Infraorbital bone not dilated. Lower jaw projecting, with a prominent inferior posterior angle, enclosed between the maxillaries. Dorsal shorter than anal, the origin of both opposite and both situated in the posterior half of the body. Pectorals in the lower half of the height. Ventrals slightly before middle of length. Caudal forked. No adipose fin. Intermaxillary, maxillary and mandible with numerous, needle-like teeth in a series, increasing in size backward, some of which are somewhat enlarged. The posterior maxillary more or less obliquely directed forward. Sometimes a few short fangs anteriorly in the mandible. Teeth on palatines, pterygoids; on vomer present or absent. Gillopening very wide, gillmembranes free from isthmus. Pseudobranchiae none. Gillrakers numerous, long, bristle-like. Branchiostegals short, 12—14.

Small bathypelagic fishes.

Synopsis of the species.

I. Colour white with black markings. No scales. Posterior maxillary teeth scarcely oblique, no conspicuous larger ones intermingled. In the mandible 62—66 teeth in a continuous series behind the hindermost fang. 7 luminous organs in the lateral series. . . . . *C. signata* p. 125.

II. Colour blackish or brown. Scales large, but very thin and deciduous. 8—9 luminous organs in the lateral series.

a. Anus slightly behind ventrals, nearer to them than to anal. Posterior maxillary teeth oblique, conspicuously larger teeth between them. In the mandible a continuous series of 90—100 vertical teeth behind the hindermost fang . . . . . *C. microdon* p. 126.

b. Anus in the middle between base of ventrals and anal. Posterior maxillary teeth very obliquely directed forward, gradually increasing in size backward, but without larger teeth between them. In the mandible a series of about 70 teeth behind the hindermost fang. . . . . *C. acclinidens* p. 127.

1. Cyclothone signata Garman.

Cyclothone signata Garman, Albatross Exp. XXVI. Fishes, 1899. p. 246.
Cyclothone signata Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 78.
Cyclothone signata Zugmayer, Campagnes Scient. Monaco XXXV. 1911, p. 95.
Cyclothone signata Max Weber, Siboga-Exp. Fische, 1913, p. 19.

B. 12—13; D. 12—14; A. 19—20; P. 9—10; V. 6—7.

Height 7, head about $4^1/_2$, eye 12, twice in interorbital space and about twice in snout. Lower jaw prominent with a ventrally directed spine at the symphysis. Front flat, laterally with 3 short blunt tubercles. Origin of dorsal and anal opposite, before beginning of last $^1/_3$ of length. Ventrals before middle, extending on anal. Pectorals nearly reaching to ventrals. Anus before middle of body, slightly behind ventrals. Intermaxillary with 6—7 nearly equal, short teeth. Maxillary with a row of 15—16 teeth, the teeth of the anterior $^1/_3$ of the row looking vertically downward, the remaining increasing in size posteriorly, slightly directed forward. Mandible with 62—66 teeth, in the anterior $^1/_7$ 2 larger canines, seperated by smaller teeth, the teeth behind gradually increasing in size posteriorly. Vomer edentulous. Palatines with 3—4,

pterygoids with 2—3 teeth. No scales. Luminous organs: a small, black suborbital, two opercular, the dorsal one below the level of the eye, the ventral one on the level of the lower base of the pectorals, 9—10 between the branchiostegals. On each side of the body 13 in a ventral series between isthmus and ventrals, 4 between ventrals and anal of which the 2 anterior ones are approximated, the second above the anus. 13 between origin of anal and caudal. 7 in a lateral series between operculum and vertical through ventrals, the first of which higher up, outside the series. Whitish with black markings on cheek and back. A pair of elongate spots on the occiput, diverging from the nape toward the eyes. A series of spots in the middle of the tail. Two transverse streaks at the base of the caudal. Short oblique streaks between the bases of the dorsal and anal rays. Length 45 mm.

Habitat: Bali Sea (1310 M.)!; Macassar straits (450 M.)!; Banda Sea (1000—2081 M.)!; Molucco passage (1500 M.)!; Manipa straits (1536 M.)!; Halmahera Sea (1000 M.)!; Timor Sea (421 M.)!. — Indic, S. 2°.30′. East Atlantic between 46°.31′ N. and Cape of Good Hope; Gulf of Panama.

2. Cyclothone microdon (Gthr.).

Gonostoma microdon Günther, Ann. Mag. Nat. Hist. (5). II. 1878, p. 188.
Cyclothone lusca Goode & Bean, Bull. Mus. Comp. Zool. X. 1883, p. 221.
Neostoma quadrioculatum Vaillant, Exp. Scient. Travailleur & Talisman, Poissons, 1888, p. 99.
Cyclothone microdon Goode & Bean, Oceanic Ichthyology, 1896, p. 99.
Gonostoma microdon Alcock, Ann. Mag. Nat. Hist. (6). IV. 1898—1899, p. 399.
Cyclothone microdon Alcock, Descript. Catal. Indian Deep Sea Fishes, 1899, p. 141.
Cyclothone microdon Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 82.
Cyclothone microdon Max Weber, Siboga-Exp. Fische, 1913, p. 18.

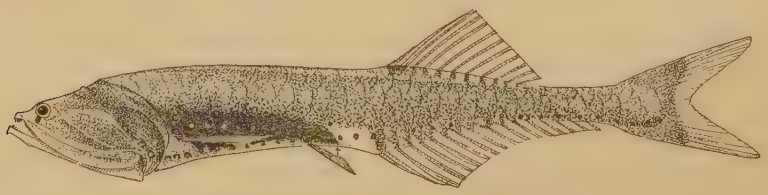

Fig. 46. *Cyclothone microdon* (Gthr.).

B. 12—13; D. 12—14; A. 17—21; P. 9—10; V. 6.

Height 8, head 5; eye 10—12, half as long as snout and interorbital space. Front slightly concave, laterally bordered

by a series of 3 blunt tubercles the last and middle of which are more approximated than the middle and the anterior. Mandible slightly prominent, with a ventrally directed spine at the symphysis. Origin of dorsal and anal opposite, far behind ventrals, which are situated slightly before middle of length and reach beyond the anus, which is situated nearer to ventrals than to anal. End of pectorals far distant from ventrals, in the middle of the body or slightly before it. Caudal deeply forked. Scales large, thin, 4 between anal and dorsal. Intermaxilla with 8—10 unequal teeth, one or two of which are enlarged. About 90—100 maxillary teeth, the anterior third of which smaller and vertically inserted. The posterior obliquely directed forward, generally increasing in size from before backward, intermingled with about 10—12 larger ones. In the anterior part of the mandibula about 12 subequel teeth between which 2 much larger ones, one behind the 3 or 4 most anterior ones the second nearly at the end of the row, behind them a continuous series of about 100 gradually increasing in size from before backward; 2—3 on the palatines, 4—6 on the pterygoids. Luminous organs small: A black suborbital one, 2 operculars above each other, the dorsal on the level of the eye, the ventral on the level of the maxilla, 9—10 between branchiostegal rays. 13 in a ventral series between isthmus and ventrals, 5 between ventrals and anal, the 2 anterior of which before anus, 14—15 between origin of anal and caudal, the 3—4 hindermost behind anal. A lateral series of 8—9 between operculum and the vertical through anus, the one or two hindermost more distant. Uniform brownish or blackish brown. Length 60 mm.

Habitat: Flores Sea (538 M.)!; Banda Sea (1000–2474 M.)!; Timor Sea (421 M.)!; Manipa strait (1556 M.)!; Molucco passage (1500 M.)!; Celebes Sea (700—2291 M.)!; Halmahera Sea (1000 M.)!. — Indic, to South of Kerguelen islands. Pacific between Behring Sea and 50° S. Atlantic between Davis Strait and 52°.39′ S.

3. Cyclothone acclinidens Garm.

Cyclothone acclinidens Garman, Albatross Exp. XXVI. Fishes, 1899, p. 246.
Cyclothone acclinidens Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 85.
Cyclothone acclinidens Max Weber, Siboga-Exp. Fische, 1913, p. 19.

B. 14; D. 13—14; A. 18—20; P. 10; V. 6—7.

Height 7 or somewhat more, head $4^1/_2$—5, eye 8—10, nearly half as long as snout and as interorbital space. Front slightly concave, laterally with 3 low, blunt tubercles. Lower jaw prominent with a sharp point at the symphysis, directed downward. Origin of dorsal and anal opposed, slightly behind the middle of length. Ventrals somewhat before that middle, nearer to anal than to pectorals, not reaching the anal. Pectorals narrow, reaching to origin of ventrals or not so far. Anus in the middle of the length and in the middle between ventrals and anal. 6—10 vertical, nearly equally large teeth in the intermaxillary. In the anterior third of the maxillary about 30—35 nearly vertical, small teeth, which increase very slightly in size from before backward; behind them stronger teeth, inclined forward, the number of which gains with age to about 20 or more, gradually becoming larger backward. In the anterior part of the mandibula about 15 equally small teeth, behind the third a large vertical fang, a second at the end of the series, behind it a series of about 70 teeth, all vertically placed and gradually increasing in size from before backward. Vomer with a series of 4—5 curved teeth, the last of which is the largest; 4—6 on the palatines, 6—8 on the pterygoids. Luminous organs small: a black suborbital, two operculars above each other, the dorsal on the level of the eye, the ventral on the level of the pectorals. 10 between branchiostegal rays, 13—14 in a ventral series between isthmus and ventrals, 4 between ventrals and anal, the 2 anterior of which before the anus; 14—16 between origin of anal and caudal. About 4 behind anal. 9—10 in a lateral series between operculum and the vertical through anus, one or two hindermost distant from the others. A luminous supracaudal patch strongly developed. Brownish, back blackish. Length 44 mm.

Habitat: Banda Sea (1500–1000 M.)!; Timor Sea (2050 M.)!; Manipa strait (1536 M.)!; Molucco passage (1500 M.)!; Halmahera Sea (1000 M.)! — Tropical Indic to New Amsterdam. Pacific along the West Coast of America, between 0°—37° N. East Atlantic between Canarian islands and 56° 30′ S.

2. Subfam. Sternoptychinae.

Body short, its anterior part elevated, compressed or elongate and the anterior part of the body not differentiated by

its height from the posterior part. Eye large, by exception telescopic. No barbel. Gape of mouth vertical or nearly so. Origin of dorsal, which may be preceded by spines, in the middle of the body or behind it, above or before that of anal. Adipose fin low, totally or partly above hinder part of anal, which may be divided. Ventrals small, below or before origin of dorsal. Scales absent, if present large, thin and exceedingly deciduous. Praeorbital, postorbital and ocular luminous organs single. Those on the mandibular symphysis, in the branchiostegal membrane and on the body in groups: between isthmus and ventrals in a ventral and more lateral series, between ventrals and caudal in one series. Body without smaller scattered luminous organs. No whitish punctiform organs on fins. Small teeth in the jaws, on vomer present or absent. Gillmembranes free from isthmus or attached to it, they may also be delicately connected. 5—11 branchiostegal rays. 4 gills. Gillrakers well developed. Pseudobranchiae present or absent.

Synopsis of the genera.

A. Body elevated, short, height $1^1/_2$. Anal short, 11—17 rays. Pseudobranchiae present.

1. Dorsal fin preceded by a forked spine. Teeth on vomer. No abrupt ventral constriction between trunk and tail. Eyes normal. Anal not divided . *Polyipnus* p. 129.
2. Dorsal fin preceded by a large triangular transparent plate. No teeth on vomer. An abrupt ventral constriction between trunk and tail.
   a. Space between trunk and tail filled by a transparent integumentary plate. Eyes normal. Anal not divided . . . . . *Sternoptyx* p. 132.
   b. Body hatchet-shaped, ventral constriction without integumentary plate. Telescopic eyes. Anal divided . . . . . *Argyropelecus* p. 134.

B. Elongate, not elevated. Height $3^3/_4$. Anal long with 23—24 rays. No pseudobranchiae . . . . . *Valenciennellus* p. 136.

1. **Polyipnus** Günther.

(Günther, Challenger Rep. Deep-sea fishes, 1887, p. 170).

Strongly compressed and elevated, but without abrupt ventral constriction between trunk and tail, covered with large but extremely thin, deciduous scales. Luminous organs before,

behind and below eye, on opercle, between branchiostegal rays, in groups along isthmus, along ventral edge, between ventrals and anal, above and behind anal, above and behind pectorals. Spiny ridges on head and belly. A strong praeopercular spine. Gape of mouth vertical, rather small, bordered above by the slender intermaxillaries, which are followed by the posteriorly broadened maxillaries. Mandibles received within the upper jaw. Eye very large, snout very short. Origin of dorsal nearly midway in length of body, preceded by a short bifid spine. A low adipose fin present. Origin of anal at the beginning of last $^1/_3$ of length. Pectorals low down, long; ventrals short. Caudal forked. Minute teeth in bands on intermaxillary and mandible, in a series on maxilla. Similar teeth on vomer. Gillopening wide, gillmembranes free from the isthmus, delicately connected. 9—11 short branchiostegal rays. Pseudobranchiae present. Gillrakers rather long.

1. Polyipnus spinosus Gthr.

Polyipnus spinosus Günther, Challenger Rep. Deep-sea Fishes, 1887, p. 170.
Polyipnus spinosus Alcock, Ann. Mag. Nat. Hist. (6). IV. 1889, p. 398. — Descr. Cat. Indian Deep Sea Fishes, 1899, p. 137.
Polyipnus spinosus Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 120.
Polyipnus spinosus Max Weber, Siboga-Exp. Fische, 1913, p. 22.

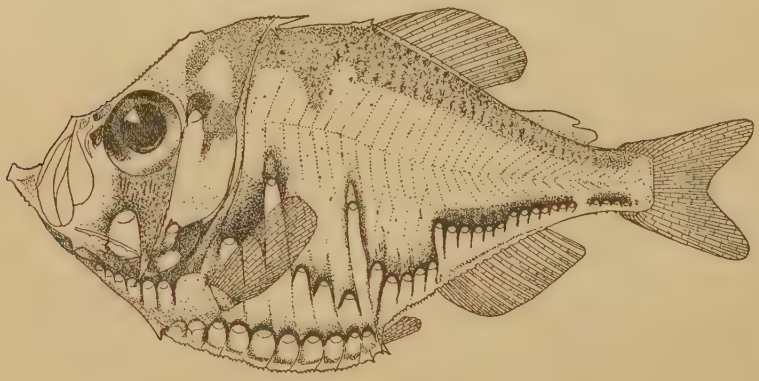

Fig. 47. *Polyipnus spinosus* Gthr.

B. 9—11; D. 12—13; A. 15—17; P. 12—14; V. 5.

Height $1^1/_3$—$1^2/_3$, head 3, much higher than long; eye $2^1/_2$. Vertical diameter of eye $^1/_2$ or somewhat more of length of head. Snout very short, less than pupil. On dorsal part of

head, 2 serrated ridges, beginning on each side behind nostril and bordering a concave space, slightly converge towards the middle of the occiput and are continued by 2 strong diverging crests, ending in a sharp recumbent spine. Edge of praeoperculum serrated near its angle, which is armed with a slender, claw-like spine, pointing vertically downward. Gape of mouth vertical, bordered superiorly by the slender intermaxillary, the maxillary, the hinder half of which is broad and posteriorly rounded, lies behind the gape. Mandibles received within the upper jaw, their lower border is denticulated. A blunt spine at the symphysis and at its inferior posterior angle. Ventral edge serrated, with an anterior and posterior spine, followed by a spinulous edge on each side between ventrals and anal. Origin of dorsal nearly in the middle of the length, preceded by a small bifid spine. Origin of anal on the beginning of the posterior third of the length. Low adipose fin in the middle of the space between dorsal and caudal. Pectorals low down, reaching almost as far as the base of the ventrals, which are small. Anus immediately before anal. Caudal forked. A band of minute curved teeth on intermaxillary and mandibles, and a single series on maxilla, similar teeth on vomer. Extremely thin, large, deciduous scales. Luminous organs: a black oval antorbital before middle of eye, a postorbital one on the same level, a suborbital below middle of eye. A smaller opercular below the level of the suborbital; 6 between branchiostegal rays. A series of 6 between isthmus and base of pectorals. A series of 10 along the ventral edge, between humeral and pelvic symphysis. 5 between ventrals and anal, the anterior of which somewhat higher than the following. Above anal and somewhat behind it, a series of 12—16, behind and separated from it a group of 4—5, decreasing in size posteriorly, the last above the first caudal ray. Two above, 3 behind the base of the pectorals, above the last of which one high up, nearly in the middle of the height of the body. Silvery, back yellowish brown. Length 85 mm.

Habitat: West Coast of Sumatra (470 m.); Madura Sea (287 m.)!; Bali Sea (538 m.)!; Macassar straits (450 m.)!; Molucco passage (397 m.)!; Arafura Sea (397 m.)!; Timor Sea (421 m.)!; Celebes Sea (457 m.). — Tropical Indic; Pacific: Sandwich islands, Atlantic: Gulf of Guinea.

Bathypelagic, probably living in shoals.

2. Sternoptyx Hermann.

(Hermann, Der Naturforscher, XVI. 1781, p. 8).

Trunk much elevated and compressed, passing ventrally abruptly with a more or less right angle into the short and compressed tail; the angle being filled up by a transparent fold of the integument, resembling thin cartilage. A similar structure forms the ventral edge of the trunk. Cleft of mouth subvertical, its upper margin formed by the very short intermaxillaries and maxillaries. Lower jaw received in the upper, its posterior inferior angle has a short spine as also the angle of the praeoperculum and the symphysis of the humeral bones. At the symphysis of the pelvic bones two spines, one looking forward, the smaller backward. Behind the anus a bifid spine. Before the dorsal, the origin of which is situated behind the middle of the body, a translucent pear-shaped plate, which has its upper border dentated, strengthened along its hindmargin by a strong spine. Anal arising on the broad transparent integumentary fold between trunk and tail. The low adipose fin begins immediately behind dorsal and reaches nearly to the anterior rays of the caudal, which is broad and forked. Pectorals close to the ventral profile, surpassing the base of the ventrals. Ventrals small. Eye large, snout very short. Numerous small unequal teeth in the jaws. Palate edentulous. No scales. Luminous organs: one behind and one below the eye, one opercular, a group on branchiostegal membrane, a group on isthmus, a series along ventral edge, one series between ventrals and anal, above anal, behind anal and above pectorals. Gillopening very wide, gillmembranes attached to the isthmus. 4 gills. Pseudobranchiae present. Gillrakers moderate.

1. Sternoptyx diaphana Herm.

Sternoptyx diaphana Hermann, Der Naturforscher, XVI. 1781, p. 8.
Sternoptyx diaphana Günther, Challenger Report Deep-sea Fishes, 1887, p. 168.
Sternoptyx diaphana Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 115.
Sternoptyx diaphana Zugmayer, Camp. Scient. Monaco, XXXV. 1911, p. 54.
Sternoptyx diaphana Max Weber, Siboga-Exp. Fische, 1913, p. 22.

B. 5; D. 9—12; A. 13—14; P. 10; V. 5.

Height generally equal to distance between snout and base of tail but varying very much according to length. Length of head $2^1/_2$ to more than 3, generally more or less below 3.

Eye generally 2, but it may be smaller or larger, according to which the point of the snout is situated above or below the level of the ventral margin of the eye. For position of fins and teeth see the diagnosis of the genus.

Luminous organs: a postorbital behind middle of eye, incon-

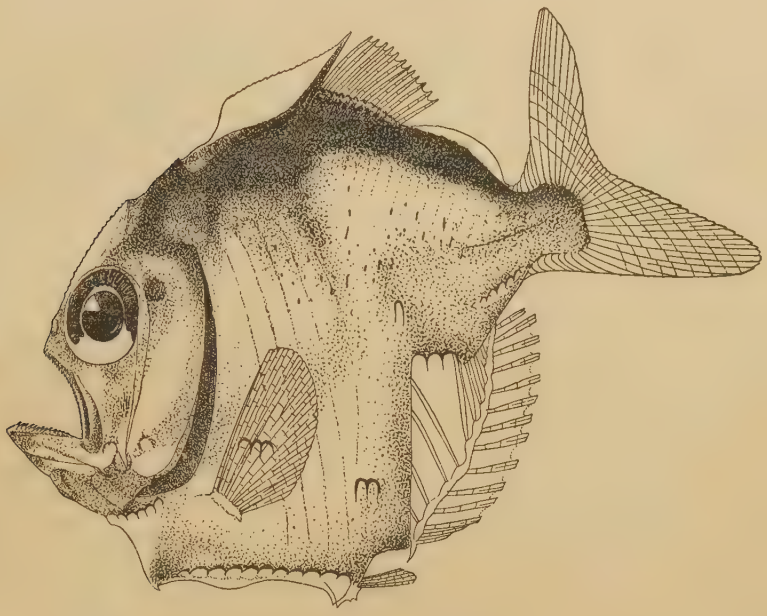

Fig. 48. *Sternoptyx diaphana* Herm.

spicuous in full grown specimens. A suborbital one close to the praeopercular spine. One ventrally on the operculum. A on group of 3 on branchiostegal membrane. In the ventral series a group of 5 on the isthmus, 10 in a close-set series on each side along the ventral edge. A group of 3 between ventrals and anal, situated far above the ventral contour. A group of 3 at the beginning of the tail above the transparent integumentary fold. A single organ slightly above and before it. A group of 4 small ones between anal and caudal. A group of 3 above the base of the pectorals. Silvery, back darkish, fins translucent. Length 45 mm.

Habitat: Bali Sea (1310 m.)!; Flores Sea (1600 m.)!; Banda Sea (2477 m.)!; Timor Sea (828 m.); Manipa straits (1536 m.)!; Ceram Sea (surface)!; Molucco passage (1500—100 m.)!; Celebes Sea (1264 m.)!. Pacific: between Yeddo and Australia; east-

ward to Sandwich islands. Indic: tropical part to New Amsterdam. Atlantic: between 46° 24′ N. to Cape of Good Hope and West India.

3. Argyropelecus Cocco.

(Cocco, Giorn. Sci. Sicil. 1829. fasc. 77. p. 146).

Strongly compressed, short, anterior part of body much elevated and higher than posterior part, which is more or less sharply deflected from the anterior, its contour carinated; especially a short ventral edge with an anterior and 2 posterior spines. Cleft of mouth subvertical, its upper margin constituted by the intermaxillary and by the curved maxillary, which enclose the mandible, which has a prominent hook at the symphysis and at the posterior inferior angle. Praeoperculum ventrally with one or two spines. Large telescopic eyes, situated close together. No scales. Luminous organs: on head before and below eyes, on operculum and in a group on branchiostegal membranes. A ventral and a lateral series on trunk, 3 groups on tail. Anterior 7—9 rays of dorsal transformed into a foliaceous, serrated plate, succeeded by 7—9 normal rays, which originate before anal. Anal divided nearly in the middle by a free interspace. A low long adipose fin in the middle between dorsal and caudal. Pectorals long and low. Ventrals very small. Caudal deeply emarginated. Upper jaw with minute teeth, lower jaw and palatines with a series of small curved teeth. Gillopening wide, gillmembranes free from isthmus and from each other. 4 gills. Pseudobranchiae present. Gillrakers long; 9 branchiostegals.

Probably bathypelagic fishes.

1. Argyropelecus olfersi (Cuv.).

Sternoptyx Olfersii Cuvier, Règne animal, 2. ed. II. 1829, p. 316.
Argyropelecus Olfersii Cuvier & Valenciennes, Hist. Nat. Poiss. XXII. 1849, p. 408.
Argyropelecus Olfersi Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 108.
Argyropelecus Olfersi Zugmayer, Camp. Scient. Monaco, XXXV. 1911, p. 52.
Argyropelecus Olfersi Max Weber, Siboga-Exp. Fische, 1913, p. 21.

B. 9; D. VII+9; A. VII+5; P. 10—11; V. 6.

Greatest height about $1^3/_5$, length of posterior part of body to that of anterior as 1:1.4–1.7. Head $3–3^1/_3$. Telescopic eye $2^1/_5$ to 3, nearly vertical, $^1/_5$ to about $^1/_3$ longer than snout. Gape of

mouth nearly vertical, nearly reaching the vertical through the middle of the eye. Mandible with a prominent spine at the symphysis and a short flat one at its posterior corner. One praeopercular spine directed downward. One spine at the shoulder. Ventral keel with a short anterior and two much stronger posterior ones,

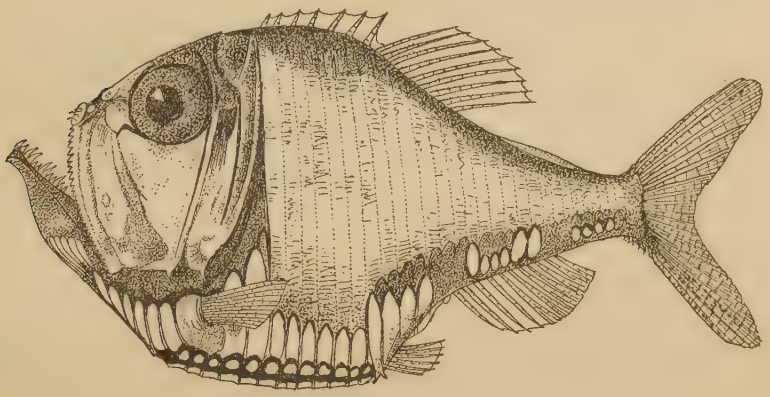

Fig. 49. *Argyropelecus olfersi* Cuv.

which are directed down- and backward. Soft part of dorsal before the beginning of the second $^1/_3$ of the length, ending before the vertical through the origin of the anal, which originates immediately behind the anus, in the beginning of the last $^1/_3$. Origin of ventrals below the middle of the second $^1/_2$ of dorsal, behind middle of length. Pectorals reaching ventrals. A long low adipose fin. Caudal deeply emarginate. Luminous organs: an antorbital below nostrils, a suborbital near posterior end of maxillary. Two operculars, the dorsal nearly on the level of the ventral margin of the eye, the inferior behind praeopercular spine. A group of 6 on the branchiostegal membrane. In the ventral series meeting that of the other side, a group of 6 behind the isthmus, along the ventral edge a series of 12 meeting those of the other side. Between ventrals and caudal, on each side 3 far distant groups, the first group before anal with 4 organs, the 2 median of which are shorter. Second group above the middle of the anal with 5—6 organs of unequal size, the middle ones of which are somewhat shorter. In the third group before the anterior rays of caudal 4 nearly equal organs. A group of 2 organs above pectorals and a series of 6 somewhat distant organs between it and the ventral. Length about 100 mm.

Habitat: Banda Sea (2798 m.)! — Indic: tropical part to New Amsterdam. Atlantic from North Cape to Cape of Good Hope, from North America to Brasil.

4. **Valenciennellus** Jordan & Evermann.

(Jordan & Evermann, Fishes of North & Middle America I. 1896, p. 577).

Elongate, strongly compressed, scaleless. Luminous organs on head; a ventral series between isthmus and ventrals and between ventrals and anal, the organs touching each other. A more lateral series of distant organs beginning at isthmus and ending at some distance before ventrals. Between origin of anal and caudal 5 groups of organs on rather large black patches. Head strongly compressed. Gape of mouth wide, very oblique, bordered superiorly by the broad, curved maxillary, which receives anteriorly the slender intermaxilla. Mandibles prominent, enclosed, very broad posteriorly with a prominent posterior inferior angle, which is the most prominent part of the ventral profile of the head. Jaws with a series of minute teeth, curved backward. Origin of short dorsal above the anterior rays of the long anal, which reaches behind the vertical through the adipose fin. Pectorals below the middle of the height, their base below the weak operculum. Ventrals short, before middle of body. Caudal emarginate. Gillmembranes free from isthmus.

1. **Valenciennellus tripunctulatus** (Esm.).

Maurolicus tripunctulatus Esmark, Vidensk. Selskaps Forhandl. Christiania, 1870, p. 488.

Maurolicus tripunctulatus Lütke, Spolia Atlantica, Scopelini, 1892, p. 269.

Valenciennellus tripunctulatus Jordan & Evermann, Fishes of North & Middle America I. 1896, p. 578.

? *Valenciennellus stellatus* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 100.

Valenciennellus tripunctulatus Max Weber, Siboga-Exp. Fische, 1913, p. 20.

D. 7; A. 24; P. 10; V. 7.

Height $3^3/_4$, head $3^1/_3$—$3^3/_4$, eye $2^1/_2$, about equal to snout. Gape of mouth very oblique, not very far from vertical. Origin of dorsal opposite to first rays of anal, in the middle of the length. Pectorals about $^2/_3$ of the length of the head, reaching to ventrals, which are short. Scales wanting. Both jaws with minute teeth. No teeth on vomer and palatines (?). Luminous organs: 16—17 organs, touching each other, in a ventral series between isthmus and ventrals. A lateral series of 10, four of which

before pectorals, the fifth above the pectorals, 2 somewhat smaller ones, close together, behind the pectorals and followed at a short distance by the larger 3 equally distant, hindermost. Between ventrals and anal a series of 5, touching each other. These and the lateral series of organs consist of round

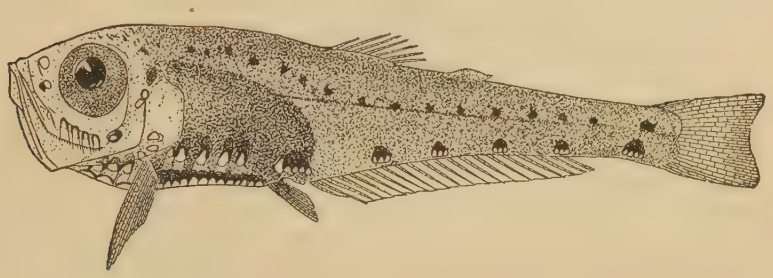

Fig. 50. *Valenciennellns tripunctulatus* (Esm.).

organs, partly silvery, partly blackish, bordered by a metallic reddish patch above. Between origin of anal and caudal 5 equally distant black spots, the first, second and third containing 3 white rounded organs, the fourth 2, and the fifth 4; an antorbital organ below nostril, a series of 4 organs underneath the cheek. 2 opercular ones, one behind the eye and one behind the maxilla, 2 or 3 on the gillmembrane. Brownish, operculum and belly silvery. A series of about 15—17 black spots between operculum and caudal. Length 40 mm.

Habitat: Timor Sea (421 m.)!. — Indic: Madagascar. Atlantic: Danmark straits (65° N. 28° W.). If *V. stellatus* of Brauer really belongs to this species, also in the northern part of the Indic and in the Atlantic, Gulf of Guinea.

5. **Stylophthalmus** Brauer.

(Brauer, Zool. Anz. XXV, 1902, p. 298. — Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 66).

Elongate, scaleless, head depressed, snout long, strongly depressed and broadly rounded, mandible prominent, its articular end angularly prominent. Eyes in the very young ones on long immovable cartilaginous stalks, which are reduced later on. Pectorals short, but rather broad. No ventrals. Origin of dorsal before vertical through anus, partly opposite to anal or not. Anus on a papilla, approximate to anal. Caudal forked or rounded. Minute sharp teeth in the jaws. At least a ventral

series of luminous organs along the body. Colourless, except a lateral series of chromatophores.

This is probably the larval and juvenile stage of an unknown Stomiatide.

1. Stylophthalmus braueri M. Web.

Stylophthalmus Braueri Max Weber, Siboga-Exp. Fische, 1913, p. 16.

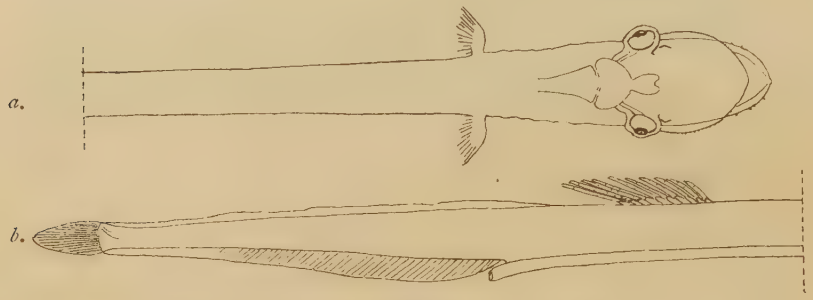

Fig. 51.

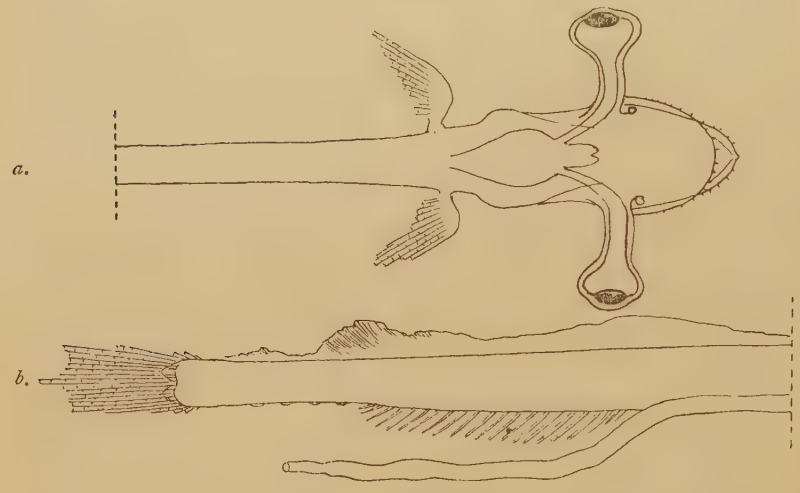

Fig. 52.

Stylophthalmus braueri M. Web. *a.* Anterior part seen from above, *b.* posterior part seen from side. Fig. 51 older stage × 9; Fig. 52 younger stage × 13, with the eyes still strongly pedunculated and the hindgut largely protruding.

D. 10. followed by a low, translucent finmembrane. Anal finmembrane with about 43 rays (both numbers of D. and A. rays may increase). Head more than $4^1/_2$. No luminous organs

visible. For form and situation of pectorals and of the eyes and for the transformation of lastnamed as well as for the reduction of the anal papilla, see the figures. Length 20 mm.

Habitat: Near Salomakié (Dammar island), (surface plankton)!; Banda sea (750 m.)!

Order MYCTOPHOIDEA [1]).

Phystome. Scaly or naked. Lateral line present or absent. Skull with a supraoccipital generally in contact with the frontals, sometimes covered by the parietals. Maxillary excluded from the gape of the mouth by the intermaxillary. Opercles well developed, or their bones reduced. Anterior vertebrae not coossified, forming no Weberian ossicles. Pectoral arch attached to the skull by a forked posttemporal, no mesocoracoid. Fins without true spines. Ventrals abdominal, by exception thoracic. An adipose fin is typically present. Gillopenings very wide, free from isthmus. Luminous organs may be present.

Artificial key to the genera.

A. Luminous organs present.
- I. A pair of phosphorescent organs on the head, covered by the thin frontal bones. No eyes. No luminous organs on body. . . . . *Ipnops* p. 179.
- II. Luminous organs in rows on body. Eyes present.
  - *a.* Height 11 or more, 60 scales in lateral line, opercular bones reduced . . . . . *Scopelosaurus* p. 175.
  - *b.* Height less than 6, 45 scales or less in lateral line, opercular bones well developed.
    - 1. Origin of anal below end of dorsal. Luminous organs partly in groups . . . . . *Myctophum* p. 151.
    - 2. Anal far distant from dorsal. A luminous organ below each of the ventral scales. . . *Neoscopelus* p. 173.

B. Luminous organs absent.
- I. No scales.
  - *a.* Origin of ventrals behind dorsal. Eye telescopic. D. 7. . . . . *Dissoma* p. 181.

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1) Having to treat only indo-australian forms, we unite under the name Myctophoidea those fishes, which are generally arranged under the Iniomi, about the validity of which large group there is no concordance among ichthyologists.

b. Origin of ventrals below dorsal. Eye ordinary.
D. 11—13. . . . . *Evermanella* p. 182.

II. Scales at least in lateral line.

a. Body totally scaly.

1. Origin of dorsal before ventrals. Ventrals shorter than pectorals. Eye large. Lower jaw prominent with a dentigerous plate. . . . . *Chloropthalmus* p. 177.

2. Origin of dorsal behind origin of ventrals. Ventrals longer than pectorals. Eye moderate. Jaws equal or subequal, without dentigerous plate.

α. Two bands of teeth on each side of palate. Inner rays of ventrals not much longer than the outer ones . . . . . *Saurida* p. 140.

β. One band of teeth on each side of palate. Inner rays of ventrals much longer than the outer ones . . . . . *Saurus* p. 144.

b. Scales only in lateral line well developed.

1. Intermaxillary with a prominent triangular tooth. Eye about in the middle of the head. Origin of anal below dorsal . . . . . *Promacheon* p. 183.

2. Upper jaw rounded. Eye near tip of snout. Origin of anal behind dorsal . . . . . *Harpodon* p. 150.

1. Saurida C. V.

(Cuvier & Valenciennes Hist. Nat. Poissons, XXII. 1849, p. 499).

Elongate, subcylindrical, tail tapering, covered with cycloid scales of moderate size. Lateral line straight, more or less conspicuously keeled on the tail. Head oblong, depressed, with a rather short pointed snout and a very wide cleft of mouth, bordered by the very long styliform intermaxillary to which the thin long maxillary is closely adherent. Eye of moderate size, partly covered by an anterior and posterior adipose eyelid. The short dorsal nearly in the middle of the length, behind it the small adipose fin, which is opposite to the short anal. Caudal forked. Pectorals above the middle of the height, rather short. Ventrals 9-rayed, with the inner rays not much longer than the outer ones and inserted before dorsal. Teeth in the jaws in several irregular rows, unequal in size, pointed, depressible and more or less curved. Similar ones on the palate in 2 bands on each side, the inner band much shorter, the outer

band with one or two rows. Numerous fine teeth on tongue and branchial arches. Branchiostegal rays 13—16. Gillopenings very wide. Opercular apparatus well developed, scaly as also the postorbital part of head. Gillmembranes free. Pseudobranchiae well developed.

Note: For larval stages see p. 149.

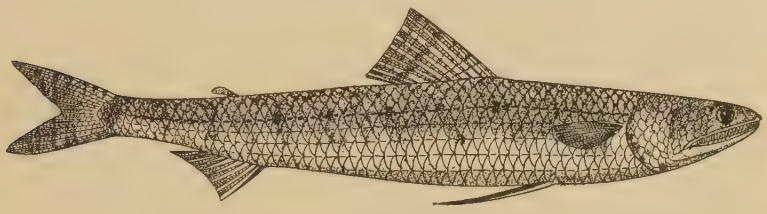

Fig. 53. *Saurida gracilis* (Q. G.).

Synopsis of the species.

I. Pectorals somewhat shorter than head without snout, reaching to twelfth scale of lateral line, which has 49—50 scales. L. tr. $\frac{4}{6—7}$; D. 12—13 . . . . . *S. grandisquamis* p. 141.

II. Pectorals shorter than postorbital part of head, reaching to ninth or tenth scale of lateral line, which has 50—63 scales. D. 11.

a. L. l. 54–63; L. tr. $\frac{4^1/_2}{7}$; B. 14–16; P. 14–15. *S. tumbil* p. 142.

b. L. l. 50–52; L. tr. $\frac{3^1/_2}{6}$; B. 12–13; P. 12–13. *S. gracilis* p. 143.

1. Saurida grandisquamis Gthr.

Saurida grandisquamis Günther, Cat. Brit. Mus. v. 1864, p. 400.
Saurida grandisquamis Günther, Challenger Rep. VI. Shore Fishes, 1880, p. 50.
Saurida grandisquamis Günther, Fische der Südsee, Heft VIII. 1909, p. 377.
Saurida grandisquamis Max Weber, Abh. Senckenb. Naturf. Gesellsch. XXXIV. 1911, p. 22.

B. 15; D. 12—13; A. 11; P. 12; V. 9; L. l. 49—50; L. tr. $\frac{4}{6—7}$.

Height $7^1/_2$, head $4^1/_4$—$4^1/_3$. Eye about $5^1/_2$, with moderately developed eyelids, slightly shorter than interorbital space and than snout, which is obtuse, broad and superiorly with a concavity, which extends to posterior part of head. Dorsal midway between snout and caudal, much higher than long, its third longest ray equal to distance between nostril and hinderborder of operculum. Its base somewhat more than postorbital part

of head. Adipose fin shorter than eye. Pectorals somewhat shorter than head without snout, extending to the twelfth or thirteenth scale of the lateral line and nearly to the vertical through the origin of the dorsal. Ventrals equal to head without snout. Caudal deeply forked, 5 times in length, and equal to height of dorsal. 16—17 scales between occiput and dorsal, 4 transverse rows of scales on cheeks, a conspicuous ridge along the caudal part of the lateral line. Pointed, unequal, depressible teeth in several rows in the jaws, the innermost the longest. 2 bands of several rows of teeth on both sides of the palate. Teeth on tongue and branchial arches. Blackish olive above, silvery below. Anterior rays of dorsal and superior rays of caudal with brown dots. Caudal dark, dorsal and ventrals in a less degree. Length more than 260 mm.

Habitat: Aru-islands!; Arafura Sea. — Louisiade Archipelago; Australia?; Malacca: Kuala Lumpur? (Duncker).

2. **Saurida tumbil** (Bl.).

Salmo tumbil Bloch, Ausländ. Fische, IX. 1795, p. 112.
Saurus badi Cuvier, Règne animal, II. 1829, p. 314.
Saurus badimottah Rüppell, Neue Wirbelth., Fische, 1835—1840, p. 77.
Saurus argyrophanes Richardson, Ichth. China, Rep. British Association of 1845. London 1846, p. 302.
Saurus undosquamis Richardson, Voyage Erebus & Terror, 1848, p. 138.
Saurida tombil Cuvier & Valenciennes, Poissons XXII. 1849, p. 500.
Saurus badi Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1859, p. 1252 & 1424.
Saurida tumbil Günther, Cat. Brit. Mus. V. 1864, p. 399.
Saurida argyrophanes Günther, Cat. Brit. Mus. V. 1864, p. 400.
Saurida undosquamis Günther, Cat. Brit. Mus. V. 1864, p. 400.
Saurida tumbil Bleeker, Atl. Ichth. VI. livr. 27, 1875, p. 155.
Saurida argyrophanes Jordan & Evermann, Proc. U. S. Nat. Mus. XXV. 1902, p. 329.
Saurida badi Jordan & Seale, Proc. U. S. Nat. Mus. XXVIII. 1905, p. 772.
Saurida argyrophanes Jordan & Herre, Proc. U. S. Nat. Mus. XXXII. 1907, p. 519.
Saurida eso Jordan & Herre, Proc. U. S. Nat. Mus. XXXII. 1907, p. 520.

B. 14—16; D. 11; A. 10—11; P. 14—15; V. 9; L. l. 54—63; L. tr. $\frac{4^1/_2}{7}$.

Elongate, subcylindrical, anteriorly depressed as also the head. Height 7—9. Head $4^1/_2$ to about five; eye with a rather broad adipose eyelid, $4^1/_2$—6, nearly equal to broad, conical snout, which has a broad, concave depression extending behind the eyes. Gape of mouth very wide, slightly oblique, the jaws equal. Dorsal short, about midway between snout and base

of caudal, its origin behind origin of ventrals. First ray longer than head without snout, following rays decreasing rapidly in size. Distance of the small adipose fin from origin of dorsal somewhat less than distance of that origin from snout. Short anal with its posterior part below adipose fin. Pectorals shorter than postorbital part of head reaching to vertical through origin of ventrals or not so far and extending to about tenth scale of lateral line. Ventrals about equal to head without snout. Caudal deeply forked. 18—21 scales between occiput and dorsal, 4 horizontal rows on cheeks. Pointed, unequal, partly depressible teeth in several rows in the jaws, uncovered by the thin lips, the innermost the largest. Similar teeth in two narrow bands on each side of the palate, the inner bands the shortest. Tongue and gillarches covered with fine teeth. Dull brown above lateral line, especially when young, mottled with dark, silvery below. Pectorals, dorsal and caudal dotted with blackish, ventrals sometimes with a dark hue, otherwise yellowish as also anal. Length 420 mm.

Nomen indig.: according to Bleeker, Buntut karbo, Lassulan (Malay.), Kedel (Javan.), Bobolesso, Waridjun, Bangballah (Sundan.), Belanka (Bintang).

Habitat: Java (Batavia!, Bantam, Tjiringin, Pasuruan, Besuki, Banjuwangi); Bali; Bawean; Sumatra (Benkulen, Padang, Priaman); Nias!; Pinang; Singapore!; Bintang; Banka; Borneo (Sarawak); Celebes (Makassar!, Bonthain, Badjoa); Ambon!; Waigeu; Schouten Islands. — Philippines, Formosa, China, Japan, Australia, Vanicolo, Sandwich Islands, coasts of Indic to Madagascar and Zansibar.

In sea, along the coasts.

3. **Saurida gracilis** (Q. G.) (Fig. 53, p. 141).

Saurus gracilis Quoy & Gaimard, Voyage de l'Uranie, Zoologie, 1824, p. 224.
Saurus ferox Eydoux & Souleyet, Voyage Bonite, Poissons, 1841, p. 197.
Saurida nebulosa Cuvier & Valenciennes, XXII. 1849, p. 504.
Saurida nebulosa Günther, Cat. Brit. Mus. V. 1864, p. 399.
Saurida nebulosa Bleeker, Atl. Ichth. VI. livr. 27, 1875, p. 156.
Saurida nebulosa Day, Fishes of India, 4°. 1878—1888, p. 505.
Saurida gracilis Günther, Fische der Südsee, Heft VIII. 1909, p. 376.

B. 12—13; D. 11; A. 9—10; P. 12—13; V. 9; L. l. 50—52; L. tr. $\frac{3^1/_2}{6}$.

Elongate, slightly depressed. Height $5^1/_2$ to more than 7,

head $4^1/_2$—5, depressed, pointed. Eye 4—$5^1/_2$, with an adipose eyelid, shorter than snout, which is broadly depressed, slightly prominent. The very wide mouth cannot completely be closed, on account of the concavity of the dentigerous part of the mandibles. Interorbital space slightly concave. Superior border of the eye at the level of the dorsal surface. Dorsal short, midway between snout and base of caudal, its origin below first half of ventrals. First ray a little longer than head without snout. Distance of the small adipose fin from the origin of the dorsal slightly less than distance of that origin from snout. Adipose fin above posterior half of anal, which is not twice as short and as low as the dorsal. Pectorals shorter than post-orbital part, reaching to ninth scale of lateral line. Ventrals longer than head without snout. Caudal forked. 18 scales between occiput and dorsal, 4 horizontal rows on cheeks. Teeth in jaws depressible, unequal, the inner series the largest; on each side of palate 2 bands of teeth, the outer band the longer, consisting of one or 2 rows, the anterior teeth of which are the longest. Tongue and gillarches covered with fine teeth. Brownish above, silvery white below, more or less marked with irregular dark crossbands or patches. All the fins may have brownish cross-bars or series or patches. Length about 300 mm.

Habitat: Nias!; Singapore; Flores; Solor; Timor; Celebes (Macassar!, Bonthain, Menado!; Tanawanko); Salayer!; Buton!; Biaru!; Siau!; Sangir islands; Karkaralong islands!; Buru; Obi major!; Ceram; Ambon!; Nusa laut!; Banda!; Halmahera; Ternate; Tiur!; Kei-islands!; Aru-islands; Schouten islands; New Guinea. — Philippines; Pacific eastward to Sandwich islands and Society islands. North to Liu Kiu islands. Indic to Red Sea, east coast of Africa, Madagascar and Mauritius.

In sea, along the shores and on coral reefs.

2. Saurus Cuvier.

(Cuvier, Règne animal, 1e éd. 1817, p. 169).

(*Synodus* auctores).

Elongate, more or less depressed or compressed, covered with cycloid scales of moderate size. Lateral line straight, sometimes slightly keeled on the tail. Head depressed with a flat, triangular snout or compressed with a blunt snout. Cleft of mouth wide, more or less oblique, bordered superiorly by

the long intermaxillaries with which the slender maxillaries are connected. Eye of moderate size, anterior with an anterior and posterior adipose eyelid. Dorsal nearly in the middle of the length, behind it the small adipose fin, which is opposite to the short anal. Caudal forked. Pectorals short, above the middle of the height. Ventrals 8-rayed, the long inner rays much longer than the outer ones. Unequal, compressed, pointed teeth in 2 or 3 rows in the jaws, more or less depressible. Similar teeth in a single band on each side of the palate. Teeth on the tongue and on the basibranchialia. 12—16 branchiostegal rays. Gillopenings very wide. Gillmembranes slightly connected. Pseudobranchiae well developed. Opercular apparatus well developed, scaly, as also the postorbital part of the head.

Note: For larval stages see p. 149.

Synopsis of the species.

I. Head compressed. Snout shorter than eye, blunt.

L. l. 55—58; L. tr. $\frac{3^1/_2}{6\,(7)}$ . . . . . *S. myops* p. 145.

II. Head depressed. Snout equal to or longer than eye, triangular, flat.

1. L. l. 48—52; L. tr. $^4/_1$ . . . . . *S. intermedius* p. 146

2. L. l. 60—64.

a. L. tr. $\frac{5—6}{10—11}$. Pectorals reaching to 10. scale of L. l., 19—20 praedorsal scales . . . . . *S. variegatus* p. 147.

b. L. tr. $\frac{3^1/_2}{8}$. Pectorals reaching to 12. scale of L. l., 17 praedorsal scales . . . . . *S. kaianus* p. 148.

1. Saurus myops (Bl. Schn.).

Salmo myops Bloch, Schneider, Syst. Ichth. 1801, p. 421. (after ms. of Forster).
Saurus myops Cuvier, Règne animal, 2e éd. 1829, p. 268.
Saurus trachinus Bleeker, Verh. Bat. Gen. XXIV. 1852, Chirocentr. p. 29.
Saurus myops Günther, Cat. Brit. Mus. V. 1864, p. 398.
Synodus myops Bleeker, Atl. Ichth. VI. Livr. 27, 1875, p. 153. (see Syn.).
Goodella hypozona Ogilby, Proc. Linn. Soc. N. S. Wales XXII. 1897, p. 250.
Trachinocephalus myops Jordan & Herre, Proc. U. S. Nat. Mus. XXXII. 1907, p. 514.
Saurus myops Günther, Fische der Südsee, Heft VIII. 1909, p. 375.

B. 16; D. 12—13; A. 15—16; P. 12; V. 8; L. l. 55—58; L. tr. $\frac{3^1/_2}{6\,(7)}$.

Elongate, head and body compressed, gradually tapering.

Height $4^1/_3$—$5^1/_2$. Head $3^1/_2$—4, eye $4^1/_2$—$6^1/_2$, situated very much forward and high, with a rudimentary adipose eyelid, longer than obtuse snout, which is about equal to the concave interorbital space. Crown of head and occiput flat, corrugated. Mouth large, oblique, with the lower jaw slightly projecting and enclosed within the outer series of intermaxillary teeth. Origin of dorsal nearer to point of snout than to small adipose fin, which is opposite to the hinder half of the anal. Pectorals above the middle of the height, reaching to about the tenth scale of the lateral line. Origin of ventrals before end of pectorals, reaching beyond base of dorsal. Caudal deeply forked. Scales cycloid, in 6 or 7 rows on the cheeks, on opercle and along the praeopercle. 17—18 scales between occiput and dorsal. Unequal, pointed teeth in 2—3 series on the jaws, a narrow band of 2 series of equal teeth on each side of the palate. Depressible teeth in a narrow patch on the tongue and behind it in a band on the basibranchialia. Silvery yellow below, dark above, with faint grey irregular longitudinal stripes. Postocular part of head and dorsal with irregular ocelli and undulated patches, bordered with dark. A scapular black patch. Fins light yellow. Length 325 mm.

Nomen indig.: Hissi-hissi (Ambon), Lumpah-lumpah, Sireh (Menado), Tjatja-witer (Batjan).

Habitat: Sumatra (Benkulen); Nias!; Banka; Bali; Lombok!; Celebes (Bonthain, Menado); Batjan; Ambon; Ceram!; Ternate; Gébé!. — Australia. West Pacific to Sandwich islands, Philippines, Formosa, China, Japan. Tropical Indic and Atlantic.

In sea.

2. **Saurus intermedius** Agass.

Saurus intermedius Agassiz, in Spix. Pisc. Brasil. 1828, p. 81.
Saurus anolis Cuvier & Valenciennes, Hist. Nat. Poissons, XXII. 1849, p. 483.
Saurus intermedius Günther, Cat. Brit. Mus. V. 1864, p. 396.
Saurus intermedius Günther, Rep. Challenger Exp. Zoology, VI. Shore Fishes, 1880, p. 50.
Synodus intermedius Jordan & Evermann, Fishes North and Middle America, 1896, p. 535.

B. 12; D. 11—13; A. 11—12; P. 13; V. 8; L. l. 48—52; L. tr. $\frac{4}{7}$.

Elongate, stout, depressed, especially before dorsal. Height 7—8, head 4, conical. Snout slightly prominent, pointed, broader than long, nearly equal to eye, which goes $4^1/_2$ times in length

of head, has an adipose eyelid and is larger than the interorbita. space, the concavity of which is continued to the occiputl Some rather strong striae behind the eye. Origin of dorsal nearer to tip of snout than to adipose fin, as high as long. The small adipose fin above the middle of the anal, the base of which is shorter than that of the dorsal. Pectorals twice in head, reaching to the ninth scale of the lateral line. Origin of ventrals below hinder half of pectorals, extending as far back as base of dorsal. Scales cycloid, large, about 6 longitudinal rows on cheeks, opercle and praeopercular margin; 17—18 scales between occiput and dorsal. An obtuse keel along the caudal portion of the lateral line. Unequal, pointed teeth in two rows in the jaws, a narrow band of several rows on each side of the palate. A narrow band of several rows of depressible teeth on the tongue and the basibranchialia. Yellowish below, back dark brown with irregular crossbands, descending below lateral line. A black blotch in the scapular region hidden by opercle. Dorsal, pectorals and caudal barred with brown. [Described after a west indian specimen].

Habitat: Arafura Sea (Günther). — Western part of tropical Atlantic.

In sea.

3. Saurus variegatus (Lac.).

? *Cobitis japonica* Houttuyn, Verh. Holl. Maatsch. Haarlem, XX. 1782, p. 450.
Salmo variegatus Lacépède, Hist. Nat. Poiss. v. 1803, p. 157.
Salmo varius Lacépède, Hist. Nat. Poiss. V. 1803, p. 224.
Saurus variegatus Quoy & Gaimard, Voyage Uranie, 1824, p. 223.
Saurus varius Günther, Cat. Brit. Mus. V. 1864, p. 395. (p. p.).
Saurus varius Klunzinger, Abh. Zool. Bot. Gesellsch. Wien, XXI. 1871, p. 589.
Synodus synodus Bleeker, Atl. Ichth. VI. Livr. 27, 1875, p. 154. (nec Esox synodus L.).
Synodus japonicus Jordan & Herre, Proc. U. S. Nat. Mus. XXXII. 1907, p. 517.
Saurus varius Günther, Fische der Südsee, Heft VIII. 1909, p. 375. (p. p.).

B. 15—16; D. 12; A. 8—9; P. 12—13; V. 8; L. l. 60—64; L. tr. $\frac{5—6}{10—11}$.

Elongate, cylindrical with back and ventral surface depressed, as also the pointed head. Height about 6, head $3^1/_2$—4, eye 5—7, with a narrow adipose eyelid, about $1^1/_2$ times in snout, about equal to concave interorbital space. Cleft of mouth wide, jaws subequal. Mandible enclosed. Origin of dorsal about midway between tip of snout and small adipose fin. Its length equal

to postorbital part of head, about equal to the height of its first ray. Anal small, shorter than snout and eye, its middle rays opposite to adipose fin. Pectorals about in the middleof the height, their tip conspicuously distant from vertical through origin of dorsal, about equal to length of snout and eye, reaching to the 10th scale of the lateral line. Ventrals about equal to head, extending to end of base of dorsal; their origin below distal half of pectorals. Scales cycloid, on the cheeks in 6 rows, a

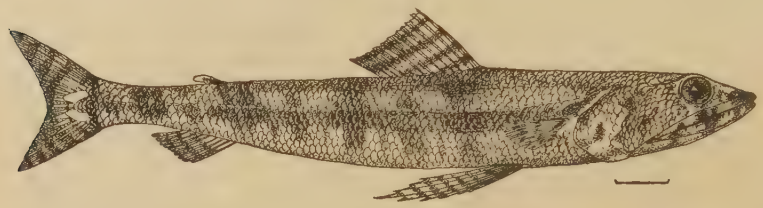

Fig. 54. *Saurus variegatus* (Lac.)

series of enlarged scales along margin of praeoperculum, 19—20 praedorsal scales. Lateral line nearly straight, not keeled on tail. Pointed teeth in the intermaxillary: an outer series of smaller and fixed ones and an inner series of larger, depressible ones. Similar teeth, but more numerous and with 2 outer series, in the lower jaw. On the vomer and palatines, in a long, narrow band, the anterior teeth longer and more crowded, 6 rows of rather large teeth on the tongue, smaller ones on basibranchialia. Dusky above, sides and below yellowish. On back and sides cross bands, the centre of which may be paler. Head with dark patches, the jaws barred. Fins, except anal and ventrals, with more or less conspicuous series of black spots. Length 240 mm.

Nomen indig.: Totate (Ternate).

Habitat: Java (Prigi); Sumatra (Trussan, Padang); Batu; Nias; Singapore; Celebes (Menado, Tombariri); Sangi; Sula Archipelago!; Ternate; Halmahera; Gebé!; Batjan; Ambon!; Binongka!; Nusa laut!; Banda!; Goram!, Tiur!; New Guinea!; Bali; Flores straits!. — West Pacific to Sandwich islands and Society islands; Philippines, China, Japan. Indic to Red Sea, Zansibar and Madagascar.

In sea.

4. Saurus kaianus Gthr.

Saurus kaianus Günther, Challenger Rep. VI. Shore Fishes, 1880, p. 50.
Synodus kaianus Gilbert, Bull. U.S. Fish. Comm. XXIII. part II. 1903 (1905), p. 588.

D. 11; A. 10; V. 8; L. lat. 63; L. tr. $\frac{3\,^1/_2}{8}$.

Body subcylindrical. Length of the head contained thrice and two-thirds in the total (without caudal). Snout depressed, pointed, nearly as broad as long, with the upper jaw projecting beyond the lower. Interorbital space slightly concave, narrower than the eye, the diameter of which is two-ninths of the length of the head. Frontal bones without sculpture. There are seventeen scales between the occiput and the dorsal fin. Dorsal fin as high as long. The pectoral fin extends to the twelfth scale of the lateral line. The series of scales on the tail without keel. Upper parts greenish, lower silvery. A series of blackish spots alternately larger and smaller along the middle of the body. Length about 140 mm. [After Günther, not seen by us].

Habitat: Near Kei islands (236 m.). — Hawaian islands (223 m.—325 m.).

In deep water.

Note on larval stages of *Saurus* and *Saurida*.

Even the still scaleless young stages of *Saurus myops* (Bl. Schn.), *Saurus variegatus* (Lac.) and *Saurida gracilis* (Q. G.) can be recognised and distinguished by a series of black patches lying in pairs along the ventral surface.

1. *Saurus myops* has 1 pair between pectorals and ventrals and 4 pairs between ventrals and anal.

2. *Saurus variegatus* has 2 pairs between pectorals and ventrals and 9 pairs between ventrals and anal. (Fig. 56, p. 149).

Fig. 55. *Saurida gracilis* (Q. G.)

a. Lower view of specimen of 40 mm.; *b*. side view of specimem of 13 mm.

3. *Saurida gracilis* has 2 pairs between pectorals and ventrals and 5 pairs between ventrals and anal.

(See MAX WEBER, Siboga-Expeditie, Fische 1913, p. 81).

Fig. 56. *Saurus variegatus* (Lac.).
a. Specimen of 13 mm.; *b.* of 45 mm.

3. **Harpodon** Lesueur.

(LESUEUR, Journ. Acad. Nat. Sc. Philad. V. 1825, p. 48).

(*Sauridichthys* Bleeker).

Elongate, rather compressed. Head thick, very short, with very short rounded snout. Scales cycloid, deciduous. Lateral line present. Cleft of mouth very wide, bordered above by the long, slender intermaxillary, the maxillary being absent. Lower jaw prominent. Unequal and partly curved, subulate, depressible teeth in a band on the jaws, especially in the lower jaw the inner ones are enlarged and conspicuously hastate. Similar teeth in one or two rows on vomer, palatines and pterygoids, as also on tongue and on the branchial arches. Dorsal in the middle of the length. Behind it the narrow adipose fin, which is about opposite to the middle of the anal. Caudal threelobed, the lateral line being continuous along the central lobe. Ventrals exceedingly long, about below origin of dorsal. Pectorals inserted above the middle of the height. Gillopenings extremely wide, covered by the membranaceous opercles. Branchiostegal membranes free and extending beyond the opercles. Branchiostegal rays 17—25.

1. Harpodon nehereus (Ham. Buch.).

Osmerus? nehereus Hamilton Buchanan, Fishes of the Ganges, 1822, p. 209.
Salmo (Harpodon) microps Lesueur, Journ. Philad. Acad. V. 1825, p. 48.
Saurus ophiodon Cuvier & Valenciennes, Hist. Nat. Poiss. XXII. 1849, p. 490.
Saurus nehereus Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1255.
Harpodon nehereus Günther, Cat. Brit. Mus. V. 1864, p. 402.
Harpodon nehereus Bleeker, Atl. Ichth. VI. livr. 27, 1875, p. 157.

B. 23—26; D. 12—14; A. 14—15; P. 11—12; V. 9; L. l. about 40.

Height 5—8. Head about 4. Eye very small, covered for a great part by an adipose membrane. Pectorals reaching to below middle of dorsal, about as long as ventrals. Scales commencing between dorsal and ventral fins, those of the lateral line behind

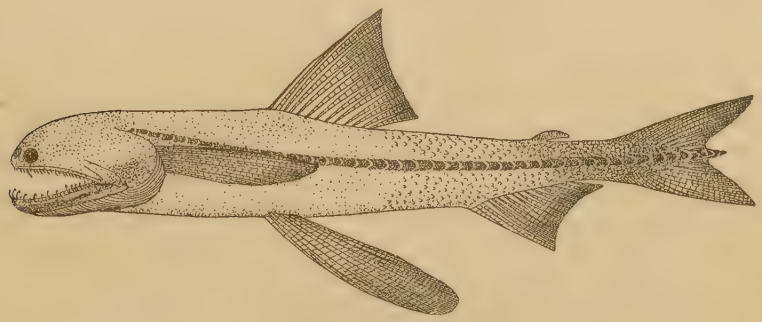

Fig. 57. *Harpodon nehereus* (Ham. Buch.).

the head. Brownish to greyish white, fins may be darkish. Length to 400 mm.

Nomen indig.: Luli, Aruan-tassik (Malay.).

Habitat: Java (Batavia, Surabaya); Madura; Sumatra (Benkulen, Padang, Priaman, Bagan api api!); Singapore; Banka; Borneo (Sinkawang, Sungiduri, Balikpapan!). — Pinang, Malacca; China. Indic: westward along the coast to Zansibar.

In sea along the coast and in estuaries.

4. Myctophum Rafinesque.

(Rafinesque, Indice d'Ittiologia Siciliana, Messina 1810 , p. 56).

(*Myctophus* Cocco, *Scopelus* Cuvier; autt.)

Slender, compressed, with more or less deciduous cycloid or ctenoid scales. Lateral line present. Gape of mouth wide, dorsally formed by the intermaxilla. Size of eye increasing

with growth. No barbel. Dorsal opposed to ventrals, its origin far before that of anal, above the hindpart of which the small adipose fin is situated. Pectorals below the middle of the height. Caudal forked. Minute teeth in several rows on jaws, vomer, palatines, pterygoids and tongue. Gillmembranes free from each other and from isthmus. Pseudobranchiae present. Gillrakers long. 8—10 branchiostegal rays. Luminous organs on head, at least one before eye, 2 behind praeopercular margin, 3 on branchiostegal membrane; for those on the body see below. There may be infra- and supracaudal luminous scales or plates. (Fig. 59).

In describing the luminous organs on the body we follow the terminology of Brauer as shown in fig. 58.

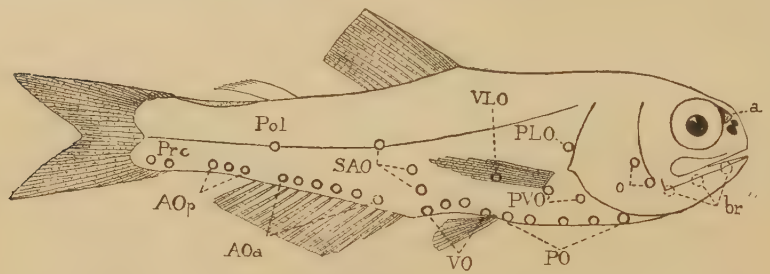

Fig. 58. *Myctophum laternatum* Garm. (after Brauer).

PO = Maculae pectorales
PVO = M. subpectorales
VO = M. ventrales
AOa = M. anales anteriores
AOp = M. anales posteriores } = A O
Pol = M. postero-lateralis
Prc = M. praecaudales

PLO = M. suprapectoralis
VLO = M. supraventralis
SAO = M. supraanales
a = antorbital organ
br = branchiostegal organs
o = opercular organs.

Synopsis of the species.

I. Luminous organs not divided by a black septum.

A. Infra- and supracaudal luminous scales. (*Lampanyctus*). 2 Pol, luminous organs kidney shaped *M. micropterum* p. 154.

B. No luminous scales. (*Myctophum*).

1. Upper jaw extending to vertical through posterior margin of eye, its posterior end strongly dilated.

a. 2 Pol. . . . . *M. benoiti reinhardti* p 155.

b. 1 Pol.

α. SAO in an oblique line. AO 5—7 + 2—3. Second VO slightly dorsally displaced outside the series. A 15—16. Last Prc near ventral profile. . . . . *M. laternatum* p. 156.

β. SAO in a blunt angle. AO 5—6 + 4—5. Second VO dorsally displaced outside the series. A. 17—19. Last Prc in lateral line or quite near it. . . . . *M. pterotum* 157.

2. Upper jaw extending far behind posterior margin of eye, its posterior end scarcely dilated. 1 Pol.

a. Snout prominent . . . . . *M. coccoi* p. 158.

b. Snout not prominent.

α. Scales cycloid.

aa. SAO in an oblique line. Eye $2^1/_3$—3.

a^2. AO 7—9 + 7—11. 3 or 4 anterior AOp above anal . . . . . *M. punctatum* 160.

b^2. AO 7—10 + 3—6; all AOp behind anal . . . . . *M. affine* p. 161.

bb. SAO in an nearly right angle. All AOp behind anal. Eye $3^3/_4$—4 . . . . . *M. evermanni* p. 162.

β. Scales ctenoid.

aa. SAO in an oblique line. P. 14. AO 6—8 + 5—7 . . . . . *M. spinosum* p. 164.

bb. SAO in an blunt angle. P. 20. AO 6—8 + 3—5 . . . . . *M. pristilepis* p. 165.

II. Luminous organs divided by a black septum.

A. The first PO and the two PVO form a straight, ascending line to the base of the pectorals. The 3 anterior VO forming a straight, obliquely ascending line. No luminous patches. (*Diaphus*).

1. Antorbital small, (and a small suborbital below anterior half of eye, Gilbert). . . . . *M. dumerili* p. 166.

2. Antorbital large.

a. A suborbital organ below posterior half of eye *M. suborbitale* p. 167.

b. No suborbital organ.

α. Pol, uppermost SAO and Prc below lateral line. End of anal below adipose fin. . . . *M. caeruleum* p. 168.

β. Pol, uppermost SAO touching lateral line.

aa. Uppermost Prc touching lateral line; origin of dorsal above that of ventrals; end of anal below adipose fin . . . . . *M. splendidum* 170.

bb. Uppermost Prc below lateral line; origin of dorsal before that of ventrals; end of anal behind adipose fin . . . . . *M. malayanum* p. 171.

B. The first PO and the two PVO form an oblique angle, all the 5 VO in a ventral series. A supra- and infracaudal luminous patch. (*Lampadena*) . . . *M. luminosum* p. 172.

1. Myctophum micropterum Br.

Myctophum (*Lampanyctus*) *oculium* Brauer, Zool. Anz. XXVIII. 1904, p. 396. (nec Garman).

Myctophum (*Lampanyctus*) *micropterum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 239.

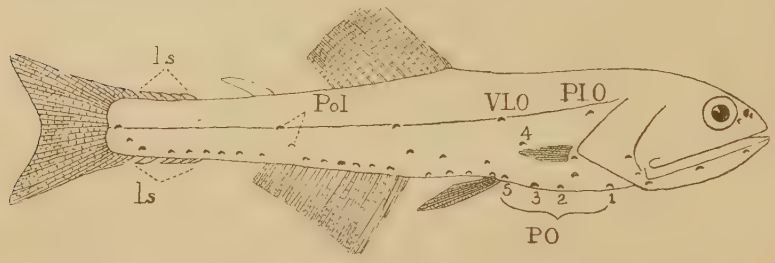

Fig. 59. *Myctophum* (*Lampanyctus*) *micropterum* Br. (after Brauer). ls infra- and supracaudal luminous scales.

D. 13—16; A. 16—18; P. 10—12; V. 8; L. l. 35.

Height 5—$5^1/_2$, head $3^1/_5$—$3^1/_2$, eye $4^1/_5$—5, $1^1/_2$ times as long as snout. Upper jaw with its posterior end slightly dilated, surpasses eye with more than one eye diameter. Praeopercular border very oblique. Origin of dorsal behind ventrals, in the middle of the length or somewhat before it. Origin of anal below middle of dorsal, behind middle of length, ending below adipose fin. Pectorals not reaching to ventrals, below middle of height of body. Scales cycloid. Luminous organs kidney-shaped. A small antorbital organ ventrally at the frontborder of the orbit. Two superposed opercular organs behind the upper jaw, 3 branchiostegal organs. 5 PO, the fourth quite outside the series above the interspace between the third and fifth, on the level of the pectoral fin or somewhat higher. The 2 PVO in a vertical line above each other and above the interspace between the first and second PO, the dorsal one close before the middle of the base of the pectorals. PLO near lateral line, before the vertical of the 2 PVO. 5 VO, the second outside

the series above and somewhat behind the first VO. AO 5—7 + 6—8, on the same level, only the anterior group above anal. 2 or 3 Prc, the posterior at the end of the lateral line, the anterior — in case there are 2 — below and before it; if preceded by a third, this one is situated at the ventro-caudal profile, at the end of the series of the posterior AO. VLO in the lateral line above origin of ventrals. 3 SAO in a blunt angle, the anterior above the space between fourth and fifth VO, the middle one somewhat higher above the origin of the anal, the uppermost in the lateral line, below middle of dorsal. 2 Pol forming with the last organ of the anterior AO an oblique ascending series, the uppermost in the lateral line, nearly below the beginning of the adipose fin. 3—5 dorsal and 5—7 ventral luminous scales. Length 74 mm. [After Brauer, not seen by us.]

Habitat: West coast of Sumatra. — Indic near Chagos archipelago and Seychelles; Tropical Atlantic.

2. **Myctophum benoiti** (Cocco) var. **reinhardti** (Lütken).

Scopelus Reinhardtii Lütken, Spolia Atlantica, Scopelini, 1892, p. 257.
Myctophum Reinhardtii Goode & Bean, Oceanic Ichthyol. 1895, p. 74.
? *Myctophum atratum* Garman, Exp. Albatross XXVI, Fishes 1899, p. 268.
Myctophum braueri Gilbert, Bull. U. S. Fish Comm. XXIII (1903) 1905, p. 598. (nec *M. braueri* Lönnberg).
Myctophum Benoiti Reinhardti Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 185.
Myctophum Benoiti Reinhardti Max Weber, Siboga-Exp. Fische, 1913, p. 86.

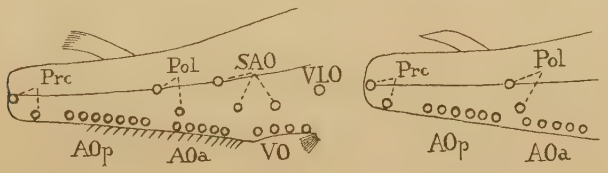

Fig. 60 Arrangement of luminous organs on tail of *Myctophum benoiti reinhardti* (Lütk.).

D. 12—14; A. 18—20; P. 13—14; V. 8; L. l. ?

Head and anterior part of body rather stout. Height 4—4 3/5, head 3—3 2/5, eye about 3 1/2, more than 2 times the rounded snout. Dilated hinderend of maxillary extending nearly to the praeopercular border. Origin of dorsal slightly behind that of ventrals, somewhat before middle of length, its last rays above first rays of anal. Adipose fin opposite to hindermost anal

rays. Pectorals situated much nearer to lateral line than to ventral profile, extending on anal. Ventrals reaching anus. Caudal forked. Scales cycloid, very deciduous. Luminous organs: a small dorsal and ventral antorbital on frontborder of orbit, two at the praeopercular margin, the larger dorsal one nearly on the level of the ventral margin of the orbit. The smaller ventral behind the maxilla, 3 branchiostegal ones. 5 PO in a series between isthmus and pectorals, the posterior PVO at the lower base of the pectorals, the anterior before it in a ventrally oblique direction, above the second PO. PLO below lateral line. 4 VO along the ventral profile. Anterior group of AO with 4—7 organs above anterior $^2/_3$ of anal. Posterior group 6—8 organs, the posterior of which are behind the anal. The most frequent formula of AO is $5+6$; distant from the latter group but at the lower profile is the anterior Prc, the posterior high up in the lateral line. The 3 SAO forming a blunt angle, dorsally open, the anterior above and slightly before the third VO, the second in the vertical through the vent, the posterior in the lateral line. Of the 2 Pol the hindermost and superior in the lateral line, above the interspace between the anterior and posterior AO, the lower Pol above or slightly before the last organ of the anterior AO. Length 25 mm.

Habitat: Banda Sea (surface plancton)!; Halmaheira Sea (1000—0 M., vertical net)!. — Tropical part of Indic; Coast of Chili; Atlantic between 34° N. and 31° S.

3. **Myctophum laternatum** Garm. [Fig. 58 p. 152].

Myctophum laternatum Garman, Exp. Albatross XXVI. Fishes, 1899, p. 267.
Myctophum (*Myctophum*) *laternatum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 178.
Myctophum laternatum Max Weber, Siboga-Exp. Fische, 1913, p. 86.

D. 11—12; A. 15—16; P. 10—11; V. 8; L. l. 32—34.

Somewhat robust and short. Height $4—4^1/_5$, head $3—3^1/_5$, eye $3—3^1/_5$. Snout about in twice eye, very blunt, with a median internarial ridge. Maxillary extending to vertical through hindborder of eye or slightly farther, dilated posteriorly. Opercle broad; anterior border of praeopercle vertical. Origin of dorsal slightly before middle of length, behind vertical through ventrals. Origin of anal below hindmost rays of dorsal. Adipose fin above the posterior half of the anal. Pectorals reaching be-

hind the base of the ventrals. Caudal forked. Scales cycloid. Luminous organs: an antorbital on the dorsal frontborder of the orbit, on the frontborder of the praeopercle a larger dorsal one, on the level of the lower margin of the eye. A smaller ventral one below it on the level of the lower part of the maxilla. Three in each branchiostegal series. 5 PO in a series from the isthmus to the base of the ventrals. 2 PVO, one at the lower opercular edge, slightly behind the second PO; the other obliquely behind it at the ventral edge of the base of the pectoral. PLO at the upper margin of the opercle. VLO in the vertical through the ventral, midway between it and the lateral line. 4 VO in a series from ventrals to anal, the second of which is slightly displaced dorsally outside the series. Above the last one a series of 3 SAO, angularly bent and obliquely directed to the lateral line. A series of 6 AOa followed behind the anal by a series of 3 AOp, which latter is separated from 2 Prc on the lower part of the end of the tail. Pol slightly behind last AOa in the lateral line. Between adipose fin and caudal a luminous patch, a smaller one between AO and Prc. Blackish, fins lighter. Length 220 mm.

Habitat: Banda Sea (1500—0 M., vertical net)!. — Indic to 26° S.; Pacific between 27° 39′ N. and 7° N.; Atlantic between 14° 39′ N. end 3° 55′ S.

4. **Myctophum pterotum** (Alcock).

? *Scopelus brachygnathos* Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Vischsoort. Menado p. 65 [1]).
Scopelus (*Myctophum*) *pterotus* Alcock, Ann. Mag. Nat. Hist. 1890, p. 217.
Myctophum fibulatum Gilbert & Cramer, Proc. U. S. Nat. Mus. XIX. 1897, p. 411.
Scopelus pterotus Alcock, Descr. Cat. Ind. Deep Sea Fishes, 1899, p. 267.
Myctophum fibulatum Gilbert, Bull. U. S. Fish. Comm. XXIV. (1903) 1905, p. 596.
Myctophum (*Myctophum*) *pterotum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 182.
Myctophum pterotum Max Weber, Siboga-Exp. Fische 1913, p. 86.

D. 11—13; A. 17—19; P. 12—16; V. 8; L. l. 28—34.

Rather stout, compressed. Height $3^4/_5$—4, head about 3, eye $2^3/_4$—3. Snout bluntly rounded, more than twice in eye. Interorbital space nearly flat, $1^1/_2$ in eye. Mouth somewhat

1) See Max Weber, Siboga-Expeditie. Fische, 1913, p. 669.

oblique. Dilated hinder end of the maxilla reaching nearly the praeopercular margin. Opercle rather broad, its membranaceous part produced. Origin of dorsal behind origin of ventrals, nearly in the middle of the length, its end above the first rays of the anal. Adipose fin above last rays of anal. Pectorals narrow, very long, reaching on anal. Scales cycloid, extremely deciduous. Luminous organs: A very small antorbital on the upper frontborder of the eye. Two opercularis on the praeopercular margin, the upper on a level with the ventral border of the eye, the smaller, lower near the angle of the maxillary. Three branchiostegal ones in a curved line. 5 between isthmus and ventrals (PO), the fifth pair of which far apart, separated by the entire width of base of ventrals. The posterior PVO at the lower base of the pectorals, the anterior in front of it, obliquely above the second PO, and covered by the opercular flap as well as PLO, which is situated high up on the level of the lateral line. 4 VO, the first, third and fourth in a series between pectorals and anus, the second displaced high up outside the series, obliquely above the first VO. The first group of AO consisting of 5—6 organs above anterior $^3/_4$ of anal, the second group beginning above last ray, consisting of 4—5 organs; separated from them the two Prc, the hindermost of which is near the lateral line. VLO much nearer to lateral line than to ventral. The 3 SAO forming a blunt angle, the anterior above the third VO, the third in the lateral line. Pol in the lateral line, above posterior part of anal. 3—4 luminous patches may be present (♂) between adipose fin and caudal. Silvery, scaleless parts blackish brown. Base of caudal and anal and upper rays of pectorals blackish. Length 100 mm.

Habitat: Macassar straits (11 M.)! — Indic; Pacific (Sandwich islands); South Atlantic (37° 31′ South).

5 **Myctophum coccoi** (Cocco).

Scopelus coccoi Cocco, Giorn. Scienz. per la Sicilia, VII. 1829, p. 143.
Alysia loricata Lowe, Proc. Zool. Soc. London, 1839, p. 87.
Scopelus coccoi Günther, Cat. Brit. Mus. V. 1864, p. 413 (p. p.).
Scopelus (*Rhinoscopelus*) *coccoi* Lütken, Spolia Atlantica, Scopelini, 1892, p. 243.
Myctophum (*Myctophum*) *coccoi* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 199.

D. 10—11; A. 19—21; P. 14—15; V. 8; L. l. 39—41.

Height $4^2/_5$—5, head $3^3/_4$—$4^1/_3$, eye $3^1/_3$—4, longer than snout, which is prominent and conical, more pointed in young specimens. End of upper jaw not much dilated, extending about one eye diameter behind eye, praeopercular margin somewhat oblique. Origin of dorsal before middle of length, behind ventrals, which are situated in the beginning of the second $^1/_3$ of the length; end of dorsal somewhat behind the vertical through origin of anal or slightly behind middle of length. End of anal slightly behind vertical through adipose fin. Scales cycloid. Luminous organs: a small dorsal and ventral antorbital organ at the frontmargin of the eye. Two opercular, the larger dorsal slightly below level of ventral orbital

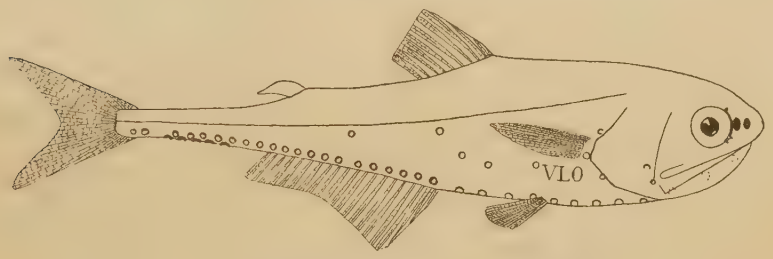

Fig. 61. *Myctophum coccoi* (Cocco) (after Brauer).

margin, the smaller ventral behind upper jaw. 5 equidistant PO, between isthmus and ventrals. Posterior PVO at the lower base of the pectorals, the anterior obliquely before and below it, above the interspace between the second and third PO. The small PLO slightly above and before the upper base of the pectorals in the vertical through the anterior PVO. 4 equidistant VO between ventrals and anus. 15—21 AO (most frequently 18) arranged in an anterior group with 4—8 and a posterior group with 9—14. The whole anterior group lies above the anal, the two anterior organs of which are separated from the following by a somewhat larger interspace. Of the posterior group nearly the whole anterior half lies also above the anal. Most frequent arrangements of AO are: 5 + 13, 6 + 11, 6 + 12, 6 + 13, 7 + 12. The two Prc are on the same level, in case the posterior AO are numerous, the Prc are serially a continuation of them, VLO nearer to origin of ventral than to lateral line. The 3 SAO arranged in a blunt angle, the anterior and inferior one about above the second VO, on the same level or somewhat lower than VLO, the

middle one in the vertical through the last VO or somewhat before, slightly higher than the anterior SAO, the uppermost near lateral line in the vertical through end of dorsal or origin of anal. Generally 6—8 supracaudal and 4—6 infracaudal luminous patches. Length 60 mm. [After Brauer, not seen by us].

Habitat: Ombai straits. — Indic to 35° S.; Pacific from near Japan to 39° S.; Atlantic 42° N. to 38° S.

6. **Myctophum punctatum** Raf.

Myctophum punctatum Rafinesque, Indice d'Ittiol. Siciliana, 1810, p. 56.
Scopelus caninianus Cuvier & Valenciennes, Hist. Nat. Poiss. XXII. 1849, p. 445.
Scopelus Heideri Steindachner, Sitzber. Akad. Wien, LXXXIII. 1881, p. 401.
Scopelus Mülleri Goode, Fish & fishery Industr. I. Nat. Hist. Aquatic Anim. Washington, 1884, Atlas, Pl. CCIII.
Myctophum (*Myctophum*) *punctatum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 188.
Myctophum punctatum Zugmayer, Exp. Monaco, XXXV. Poissons 1911, p. 26.
Myctophum punctatum Max Weber, Siboga-Exp. Fische, 1913, p. 86.

D. 12—14; A. 18—20; P. 14—15; V. 8—9; L. l. 40—44.

Elongate. Height 4—$4^1/_2$, head $3^2/_5$ to more than 4. Eye $2^1/_3$—$2^3/_5$, about 3 times longer than snout, which has a median crest, is strongly curved, nearly vertically sloping down to the mouth. Mouth slightly oblique, hinderend of maxilla slightly dilated, surpassing posterior border of eye. Origin of dorsal opposite to origin of ventrals, situated before the middle of the length of the body, its end opposite to origin of anal, the end of which lies behind the vertical through the hindborder of the adipose fin. Pectorals situated in the middle of the height of the body, surpassing the origin of the ventrals, which extend to the anus. Scales cycloid, their surface minutely spinulous. Luminous organs: an antorbital on the posterior dorsal and on the anterior ventral border of the eye. 2 praeopercular organs,

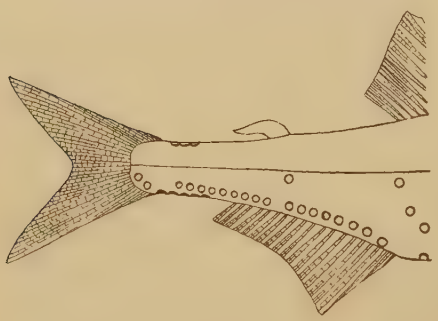

Fig. 62. *Myctophum punctatum* Raf. (after Brauer).

the dorsal slightly below the level of the ventral orbital margin the lower behind the angle of the maxillary; 3 branchiostegal ones. 5 equidistant PO in a series between isthmus and ventrals. The posterior PVO at the lower base of the pectoral, the anterior one before and below it, opposite to the second PO. PLO obliquely above the pectoral but below the lateral line. 4 VO in a continuous series between ventrals and anus. Anterior AO 7—9, generally 8, above the anterior $^2/_3$ of the anal. Posterior group (AOp) 8—10, mostly 8, the anterior 3 or 4 of which are situated above the last $^1/_3$ of the anal. 2 Prc, the last of which lies higher but conspicuously below the lateral line. 3 SAO in a steeply ascending oblique or slightly concave line, the most ventral of them above or somewhat before the last VO; the uppermost near the lateral line in the vertical through the origin of the anal. Pol somewhat below the lateral line, above the last anterior AO. 2—3 supracaudal luminous plates in the male, 4—5 infracaudal ones in the female. Steel blue. Length 100 mm.

Habitat: Banda Sea (surface)!. Near northcoast of New Guinea. — Admirality islands. Mediterranean. Atlantic from about 60° N. to Canarian islands.

7. **Myctophum affine** (Lütken).

Scopelus affinis Lütken, Spolia Atlantica, Scopelini, 1892, p. 252.
Myctophum affine et opalinum, Goode & Bean, Oceanic Ichthyol. 1895, p. 72.
Myctophum nitidulum Garman, Exp. Albatross, XXVI. Fishes, 1899, p. 266.
Rhinoscopelus oceanicus Jordan & Evermann, Bull. U. S. Fish. Comm. XXII. (1902) 1904, p. 168.
Myctophum margaritatum Gilbert, Bull. U. S. Fish. Comm. XXIII. (1903) 1905, p. 596.
Myctophum (*Myctophum*) *affine* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 190.
Myctophum affine Gilbert, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. 1908, p. 217.
Myctophum affine Zugmayer, Exp. Monaco, XXXV. Poissons. 1911, p. 27.
Myctophum affine Max Weber, Siboga-Exp. Fische, 1913, p. 87.

D. 12—13; A. 20; P. 15; V. 9; L. l. about 41.

Height 4—$4^1/_2$, head about 4, eye $2^2/_3$—3, more than twice length of the bluntly rounded, declivous snout, which has a median keel. Mouth oblique. End of upper jaw dilated, reaching nearly to angle of praeoperculum. Origin of dorsal much nearer to tip of snout than to root of caudal, above

or slightly behind root of ventrals, its hindermost rays above foremost rays of anal. Adipose fin opposite to hindpart of anal. Pectorals nearly $^2/_3$ of length of head, not reaching middle of ventrals. Ventrals not reaching vent. Caudal forked. Scales cycloid, thin, not spinous, deciduous. Luminous organs: a minute round antorbital on the lower anterior orbital margin; 2 operculars, the larger dorsal one below the level of the ventral orbital margin, the smaller lower one behind angle of intermaxillary, partly covered by the margin of the praeopercle. 3 branchiostegals. 5 PO in a straight series between isthmus and ventrals, the 3 anterior ones are more distant than the posterior ones. Of the 2 PVO the posterior is situated before the lower base of the pectoral, the anterior before and below it, above the second PO. PLO above the space between them, slightly below the lateral line. 4 VO in a straight line between ventrals and anus. Number of AO variable from 7 to 10 in the anterior group, which alone lies above the anal and 3—7 in the posterior group, which begins above the last anal ray or immediately behind the anal; the most frequent arrangement is after Brauer: $7 + (5—6)$, $8 + 5$ and $9 + 5$. The 2 Prc straightly or slightly obliquely behind each other. Arrangement and situation of the 3 SAO and of Pol as in punctatum. There may be a supra caudal luminous patch. Dusky brown above, silvery below, specked with brown. Fins translucent, base of caudal blackish. Length 80 mm.

Habitat: Banda Sea (1500—0 M., vertical net)!. — Pacific: Chinese Sea; East Coast of Australia; West Pacific islands; coast of Chili to 30° S. Indic 11° 40′ N. to 23° S. Atlantic 38° 40′ N. to 40° S.

8. **Myctophum evermanni** Gilbert.

Myctophum evermanni Gilbert, Bull. U. S. Fish. Comm. XXIII. 2. (1903) 1905, p. 597. — Mem. Mus. Comp. Zool. Harvard Coll. XXVI. 1908, p. 218.
Myctophum evermanni Max Weber, Siboga-Exp. Fische, 1913, p. 87.

D. 13—15; A. 20; P. 15; L. l. 39.

Height $4^1/_2$—$4^4/_5$, head 3—$3^1/_5$, eye $3^3/_4$—4. Rounded snout about $1^1/_2$ times in eye. Dorsal profile of head with a concavity above the eyes. Upper jaw slightly dilated behind, nearly reaching the rounded praeopercular margin. Origin of dorsal about midway in the length of the body (without caudal),

slightly behind the origin of ventrals, its hindermost rays opposite to the origin of the anal. Adipose fin opposite to the last dorsal rays. Caudal forked. Scales cycloid, thin, deciduous. Luminous organs: A small dorsal and ventral antorbital at the frontmargin of the eye. Two operculars, a larger dorsal one somewhat below the level of the ventral margin of the eye, a smaller ventral one behind the angle of upper jaw; 3 branchiostegal ones; 5 nearly equally distant PO, between isthmus and ventrals. 2 PVO, one before the lower base of the pectoral, the other obliquely before and below it and above and slightly before the second PO. PLO below the lateral line, above the interspace between the two PVO. 4 equidistant VO in a series between ventral and anus. 12—13 AO in 2 groups, the anterior containing 7—9 above the anterior $^3/_4$ of the anal, the posterior group beginning above the last anal ray or behind it, containing 4—6; the most frequent arrangement being 8 + 5, others are: 7 + 5, 7 + 6, 9 + 4. Separated from them by an interspace the 2 Prc, a little obliquely arranged. VLO nearly in the middle between lateral line and origin of ventrals. 3 SAO nearly forming a right angle, the first above the second VO, the second in the same level as the first, above and slightly behind the last VO, the third quite near the lateral line above and somewhat behind the second, about in the vertical through the anus. Pol near the lateral line, above the last organ of the anterior group of AO. Brownish to blackish, except sides of head which are whitish. Length nearly 50 mm.

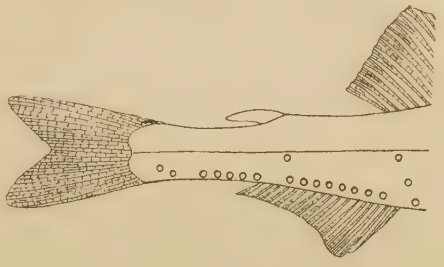

Fig. 63. *Myctophum evermanni* Gilb. (after Gilbert).

Habitat: Halmahera Sea (surface)!; Banda Sea (2000—0 M., vertical net)!; Manipa strait (1536—0 M., vertical net)!. — Round Hawaian Islands.

9. **Myctophum spinosum** (Steind.).

Scopelus spinosus Steindachner, Ichthyol. Notizen, V. Sitzber. Akad. Wien, LV. 1867, p. 711.

Scopelus spinosus Lütken, Spolia Atlantica, Scopelini, 1892, p. 239.
Myctophum (*Myctophum*) *spinosum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 196.
Dasyscopelus spinosus Gilbert. Mem. Mus. Comp. Zool. Harvard Coll. XXVI N°. 6, 1908, p. 220.
Myctophum spinosum Max Weber, Siboga-Exp. Fische, 1913, p. 87.

D. 13—14; A. 19—20; P. 14; V. 8; L. l. 40.

Height 4 or somewhat more, head about 4, eye $2^2/_5$ to nearly 3, snout very short, less than $^1/_3$ of eye, end of upper jaw slightly dilated, reaching not far behind posterior border of eye. Origin of dorsal before middle of length, somewhat behind origin of ventrals, ending slightly before origin of anal. Adipose fin above end of anal. Pectorals somewhat below middle of height of body, nearly reaching to vent. Caudal forked. Scales large, ctenoid, with many fine teeth, those of the ventral scales are large and few in number. Luminous organs: A small dorsal and ventral organ at the front margin of the orbit, two operculars, the larger dorsal one below the level of the ventral margin of eye, the smaller ventral one below it, on the level of the hindmargin of the upper jaw; 3 branchiostegals. Of the 5 PO between isthmus and ventrals, the 3 posterior ones are equidistant, but somewhat separate of the two anterior ones. The posterior PVO below lower base of pectoral, obliquely before and below it the anterior one, which lies above the second PO. PLO above the anterior PVO nearer to base of pectoral than to lateral line. 4 VO, equidistant in a series between ventral and anus. 12—15 AO in two groups, in the anterior 6—8 above the anterior $^2/_3$ of the anal, in the second group 5—7, the two anterior of which lie above the end of the anal. The two Prc far distant from the AO, a little obliquely arranged. VLO nearer to lateral line than to ventral fin. The 3 SAO in an oblique or very slightly concave line; the inferior one above the space between the third and fourth VO, the middle one above the last VO, the upper and more distant one just below the lateral line in the vertical through the end of the dorsal. Pol slightly below the lateral line, above last AO of the anterior group. About 7 supracaudal and 3 infracaudal luminous patches. Colour dark blue above, silvery below. Length nearly 90 mm.

Habitat: Celebes Sea (surface)!; Ombai straits. — Indic. West Pacific and East Atlantic.

10. Myctophum pristilepis (Gilbert & Cramer).

Myctophum (*Dasyscopelus*) *asperum* Bleeker, Atl. Ichth. VI. livr. 27. 1875, p. 159 (nec Richardson).
Dasyscopelus pristilepis Gilbert & Cramer, Proc. U.S. Nat. Mus. XIX. 1897, p. 412.
Dasyscopelus pristilepis Gilbert, Bull. U.S. Fish. Comm. XXIII, 2. 1903 (1905), p. 600.
Myctophum pristilepis Gilbert, Bull. Mus. Comp. Zool. Harvard Coll. XLVI. 1906, p. 259.
Myctophum pristilepis Max Weber, Siboga-Exp. Fische, 1913, p. 88, 669.

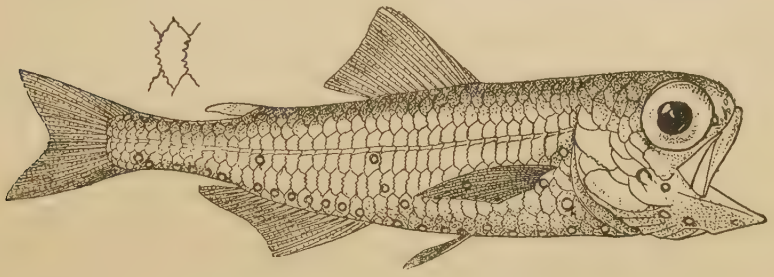

Fig. 64. *Myctophum pristilepis* (Gilb. & Cram.) and a ventral scale.

D. 12—13; A. 18; P. 20; V. 8; L.l. 35—38.

Height $4^1/_2$, head $3^1/_2$, eye $2^3/_5$; snout bluntly rounded, very short, less than $^1/_3$ of eye, its tip nearly on a level with lower border of pupil. Interorbital space nearly flat. Mouth very oblique. Upper jaw reaching to vertical through posterior margin of eye. Origin of dorsal before middle of body, above or slightly behind origin of ventrals, ending before origin of anal. Adipose fin opposite to posterior part of anal. Caudal forked. Scales large, firm, ctenoid, their edges with rather stout teeth, absent or obsolescent on the scales of the lateral line, which are vertically enlarged. Large scales on opercles and cheeks. Luminous organs: an antorbital at the ventral part of the frontal margin of the orbit, a dorsal one only evident in the young (Gilbert). Two operculars, a larger dorsal one slightly below the level of the inferior margin of the eye, the much smaller ventral one behind the angle of the upper jaw. 3 branchiostegal organs; 5 nearly equidistant PO, the fifth outside and somewhat upward of the series between isthmus and ventral. Posterior PVO immediately before lower base of pectoral, the anterior obliquely before and below it, above the

second PO, above and before upper base of pectoral, nearly midway between it and the lateral line. 4 VO in a series between ventrals and anus. 10—13 AO in two groups, the anterior group, situated above the anal, contains 6—8, the posterior group, beginning above last anal ray or behind it, contains 3—5 organs, the most frequent arrangement being 7 + 4. Widely separated from them the two Prc, which are rather close together, obliquely arranged, the posterior one in the middle between the lateral line and the ventral profile. VLO midway between origin of ventral and lateral line. 3 SAO in a curved line with the concavity forward, the anterior above and slightly before the last VO, the middle one in the vertical through the anus, the uppermost immediately below lateral line. Pol immediately below the lateral line, about above last AO of the anterior group. An infracaudal luminous patch. Silvery, snout yellowish white, top of head and back blackish. Length 75 mm.

Habitat: Macassar Straits (surface)!; Halmahera Sea (1000—0 M., vertical net)!; Banda Sea (surface)!; Arafura Sea (surface)!; Bali, Celebes and Batjan (Bleeker). — Mauritius; Hawaian islands.

11. **Myctophum dumerili** (Blkr.). [1])

Scopelus Dumerili Bleeker, Act. Soc. Scient. Ind. Neerl. I. 1856, Beschr. Vissch. Menado, p. 66.
Myctophum nocturnum Poey, Mem. Hist. Nat. de Cuba 1860, II. p. 426.
Myctophum (*Scopelus*) *Dumerili* Bleeker, Atl. Ichth. VI. livr. 27. 1875, p. 158.
Lampanyctus lacerta Goode & Bean, Oceanic Ichthyology 1895, p. 81.
? *Diaphus urolampus* Gilbert & Cramer, Proc. U. S. Nat. Mus. XIX. 1896, p. 408.
Myctophum (*Diaphus*) *lacerta* Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 214.
Diaphus nocturnus Gilbert, Bull. Mus. Comp. Zool. Harvard Coll. XLVI. 1906, p. 255.

D. 15—16; A. 15—16; P. 12; V. 8—9; L. l. about 34.

Height more than 5, head $3^1/_4$. Eye 3—$3^1/_3$, more than $^1/_2$ longer than snout. Upper jaw scarcely dilated at its hinder end, nearly reaches to the praeopercular margin, which is oblique. Dorsal in the middle of the body, its origin before middle,

1) See Max Weber, Siboga-Expeditie Fische 1913, p. 670.

opposite to origin of ventrals. Anal equal to dorsal or slightly shorter, its origin somewhat behind end of dorsal. The small adipose fin opposed to hindermost rays of anal. Pectorals pointed, shorter than postorbital part of head, reaching ventrals, which are longer than the pectorals. Caudal deeply incised. Scales cycloid. Luminous organ: Antorbital small [1]). Two operculars, a larger dorsal one below the level of inferior margin of eye, a smaller lower one behind upper jaw. 3 branchiostegal ones. 5 PO, the 3 anterior and the fifth equidistant, the fourth above the third. 2 PVO, the posterior one near lower base of pectoral, the anterior one obliquely before and below it. PLO nearer to lateral line than to base of pectorals. 5 VO, the first, fourth and fifth in a ventral series, the second and third in the space between the first and fourth, forming with the first an obliquely ascending line, the second being closer to the first than to the third. AO in 2 groups, the anterior group with 5—7, the posterior with 4—6 organs. The first and last anterior one may lay higher up outside the series. The second group begins behind the anal. 4 Prc in a curved line, the hindermost high up near lateral line. VLO nearer to lateral line than to origin of ventrals. SAO in a straight or slightly curved line, the lower one above anus, the upper one in the vertical through end of dorsal, quite near lateral line, as also Pol. Violet brown, opercles silvery. Length 80 mm. [Bleeker's typical specimens seen by us].

Nomen indig.: Bulan bulan (Menado).

Habitat: Celebes (Menado)!. — Tropical Indic. Pacific: Hawai (*M. urolampus*). Atlantic between 39° N. and 37° S.

12. **Myctophum suborbitale** (M. Web.).

Diaphus suborbitalis Max Weber, Siboga-Exp. Fische, 1913, p. 90.

D. 15; A. 14; P. 12; V. 9; L. l. circa 38.

Height more than $4^1/_2$ to nearly 5, head $3^1/_2$, eye $3^1/_3$—$5^3/_5$. Snout $2^1/_4$ in eye, very short and steeply descending, with a strong median keel running in the interorbital space which is $^1/_6$ broader than eye diameter. Mouth oblique. Upper jaw

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1) Diaphus nocturnus, which we have cited as a synonym, has according to Gilbert a small suborbital organ below the anterior portion of the orbit.

with its hinder end scarcely dilated, surpassing eye with $1^1/_2$ eye diameter. Praeopercular margin very oblique. Origin of dorsal immediately behind vertical through origin of ventrals, situated before middle of length, its distance from snout much larger than its distance from hindborder of adipose fin. Origin of anal below middle of last $^1/_3$ of dorsal. Pectorals below middle of height, surpassing origin of ventrals. Ventrals reaching to about seventh anal ray. Scales cycloid. Luminous organs: a somewhat pearshaped antorbital organ, dorsally from nostril, with its long axis parallel to the axis of the body, its point extending to the median crest of the snout; a roundish suborbital organ, somewhat behind the middle of the pupil, its dorsal border extends to the level of the iris and is bordered with black, its lower silvery half reaches to maxillary. 3 branchiostegals; 2 operculars above each other, the smaller lower one behind upper jaw. 5 PO, the fourth outside the series, above and somewhat behind the third, the first and second separated by a space much larger than that between the following. The 2 PVO in an oblique line, the posterior near the upper base of the pectoral, the anterior obliquely before and below it, above the interspace between the first and second PO. PLO nearly midway between pectoral and lateral line, at its lower border a large luminous scale. 5 VO, the second and third outside the series, the third higher than the second. 11—12 AO, the anterior group, above the anterior $^2/_3$ of the anal, contains 6 organs, the anterior and posterior of which are outside and above the remaining. The posterior group contains 5—6 organs in a series beginning above the last anal ray. 4 Prc, the hindermost close to the lateral line and distant from the 3 anterior ones which are situated at the ventral profile. VLO much nearer to lateral line than to origin of ventral. 3 SAO vertically above the anus, the uppermost close to the lateral line as also Pol, which lies above the last organ of the anterior AO. Length about 95 mm.

Habitat: Bali Sea (521 M.)!; Banda Sea (1500—0 M. vertical net)!; Arafura Sea (560 M.)!.

13. **Myctophum caeruleum** (Klunz.) [Fig. 65, b; p. 171]

Scopelus caeruleus Klunzinger, Abh. Zool. bot. Ges. Wien XXI. 1871, p. 592.
Scopelus engraulis Günther, Challenger Rep. XXII, Deep-Sea Fishes, 1887, p. 197.

Scopelus engraulis Alcock, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 129. — Descr. Catal. Indian Deep-Sea Fishes, 1899, p. 161.
Scopelus (Nyctophus) caeruleus Lütken, Spolia Atlantica, Scopelini, 1892, p. 260.
Lampanyctus caeruleus Goode & Bean, Oceanic Ichthyol. 1896. p. 81.
Myctophum (Diaphus) caeruleum Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 217.
Diaphus caeruleus Max Weber, Siboga-Exp. Fische, 1913, p. 88.

D. 12—14; A. 15; P. 10—12; V. 8—9; L. l. 37.

Height $4^3/_5$—5, head $3^1/_2$—$3^2/_3$, eye 4—5, more than half its diameter longer than snout, which is half as broad as interorbital space. Upper jaw slightly dilated at its hinder end, which surpasses the eye by more than one eye diameter. Origin of dorsal above origin of ventrals or slightly before or behind it; in the middle of the distance between snout and adipose fin or behind it. Origin of anal somewhat behind end of dorsal, before last $^1/_3$ of length, ending below adipose fin. Pectorals far below middle of height, not reaching origin of ventrals (after Brauer: reaching on ventrals). Caudal forked. Scales cycloid. Luminous organs divided by a black septum. An antorbital organ, narrowed between eye and nostril, slightly dilated dorsally, more dilated ventrally, extending on ventral border of eye. 2 operculars, quite close above each other, the ventral one, which is smaller, behind end of upper jaw; 3 branchiostegals; 5 PO, the fourth outside the series above the space between the third and the fifth. The 2 PVO in an oblique line, the superior at the ventral base of the pectoral, the inferior above and behind the first PO. PLO above base of pectoral, nearer to it than to lateral line. 5 VO, the second and third outside the series, the third higher than the second. 11 AO in two groups, the anterior above the anal with 6 organs, the anterior and posterior of which are situated higher up outside the series, the posterior group behind anal contains 5 organs, separated from them the 4 Prc, which are arranged in a continuous, semicircular series, the hindermost in the middle between lateral line and ventral profile. VLO between lateral line and ventral, nearer to lastnamed; the 3 SAO in an oblique ascending line, the most ventral between last VO and anus, the uppermost far distant from lateral line, as also the Pol, which lies close above and behind the last organ of the anterior AO. Silvery, back blackish blue. Fins hyaline. Length more than 150 mm.

Habitat: Molucco Passage (1500—0 M., vertical net)!; Celebes Sea off Mindanao (457 M.); West Coast of Sumatra (371 M.). — Andaman Sea, Red Sea.

14. Myctophum splendidum Br.

Myctophum (*Nyctophus*) *splendidum* Brauer, Zool. Anz. XXVIII. 1904, p. 399.
Myctophum (*Diaphus*) *splendidum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 218.
Diaphus splendidus Max Weber, Siboga Exp. Fische, 1913, p. 90.

D. 13—15; A. 15—16; P. 11; V. 8. L. l. 38—39.

Height somewhat above or below 5, head 3—$3^1/_2$, eye $3^1/_2$ to more than 4, $^1/_3$ longer than rounded snout. Upper jaw with its hinder end scarcely dilated, surpassing eye by about one eye diameter. Praeopercular margin oblique. Origin of dorsal above origin of ventrals, before middle of length. Origin of anal slightly behind end of dorsal, somewhat before beginning of last $^1/_3$ of length, ending below adipose fin. Pectorals far below middle of height, not reaching the ventrals. Caudal forked. Scales cycloid. Luminous organs: 2 united antorbital organs before anterior border of eye, not extending on ventral orbital margin. 2 operculars, obliquely above each other, the smaller lower one behind upper jaw; 3 branchiostegals; 5 PO, the fourth outside the series, far above the space between third and fifth, first and second far more distant than the following. The 2 PVO in an oblique line, the superior before the ventral base of the pectoral, the inferior above the space between the first and second PO. PLO between lateral line and upper pectoral base, nearer to lastnamed, at its lower border a large, luminous scale. 5 VO, the second and third outside the series, the third higher than the second. 10—13 AO in two groups, the anterior above the anal with 5—7, the anterior and posterior of which are situated higher up outside the series, the first upwards before or above the second; the posterior group contains 4—6 organs, in one series behind the anal, the last of them generally smaller. 4 Prc, the hindermost distant from the 3 anterior and situated close to the lateral line. VLO between ventral and lateral line, much nearer to lastnamed. 3 SAO in an oblique or very slightly concave, ascending line above the space between last VO and vent; the middle one close to it, the uppermost

touching the lateral line as also Pol, which lies above the last organ of the anterior group of AO. Length 90 mm.

Habitat: Madura Sea (289 M.)!. — Tropical Indic; Atlantic; Gulf of Guinea.

15. **Myctophum malayanum** (M. Web.).

Diaphus malayanus Max Weber, Siboga-Exp. Fische, 1913, p. 89.

D. 15; A. 15; P. 10; V. 9; L. l. circa 35.

Height $4^1/_2$, head $3^3/_{10}$, eye $3^3/_5$, $^1/_3$ longer than snout, which is half as broad as interorbital space. Upper jaw slightly

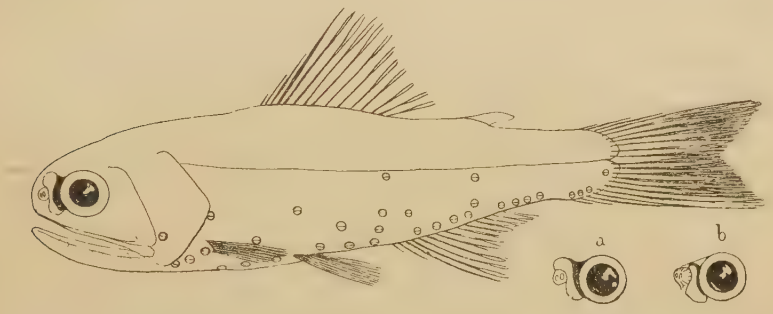

Fig. 65. *Myctophum malayanum* (M. Web.). — Antorbital organ between eye and nostrils, a of *M. malayanum*, b of *M. caeruleum*.

dilated at its posterior end, which surpasses eye by more than one eye diameter. Praeopercular border narrow. Origin of dorsal before origin of ventrals, both before middle of length. Origin of anal below posterior end of dorsal, somewhat before beginning of last $^1/_3$ of length, its end behind adipose fin. Scales cycloid. Pectorals far below middle of height, extending to origin of ventrals. Luminous organs: a large antorbital organ, hatchet-shaped on account of its dorsal part, which is dorsally bent over the nostril, but broadly separated from the opposite organ, it reaches ventrally to the ventral border of the eye. Two operculars close together above each other, the ventral one, which is smaller, behind end of upper jaw, 3 branchiostegals. 5 PO in an irregular series, the fourth far outside it above the space between the third and fifth, the distance between the first and second by far the largest. The 2 PVO in an oblique line, the superior and posterior at the ventral base of the pectoral, the inferior before and slightly below it, close to the first PO. PLO between lateral line and

pectoral, much nearer to lastnamed. 5 VO, the second slightly, the third far outside and above the series. 10—12 AO in 2 groups, the anterior above the anal with 5—7 organs, the anterior and posterior of which are situated higher up ouside the series, the posterior group beginning above or slightly behind the last anal ray with 4—5 organs. 4 Prc, 3 close together at the ventral profile, the fourth far distant, near lateral line. VLO midway between origin of ventral and lateral line. The 3 SAO in a slightly oblique, ascending line, the uppermost organ slightly above and behind the fifth VO. Close to it the middle one, on the same level as the first organ of the anterior group of AO, the uppermost rather far distant, close to lateral line, even as Pol, which is situated in the vertical through adipose fin. Silvery, back brownish. Fins hyaline. Length 36 mm.

Habitat: Halmahera Sea (1000—0 M., vertical net)!; Banda Sea (2000—0 M., vertical net)!.

16. **Myctophum luminosum** Garm.

Myctophum luminosum Garman, Albatross Exp. XXVI. Fishes, 1899, p. 263.
Myctophum (*Lampadena*) *luminosum* Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 208.

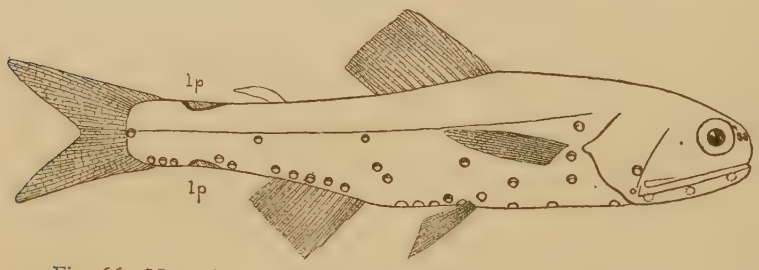

Fig. 66. *Myctophum* (*Lampadena*) *luminosum* Garm. (after Brauer)
lp luminous patches.

B. 8; D. 13—14; A. 13—14; P. 16; V. 8; L. l. 38.

Height 5, head $3^3/_4$, eye $4^1/_2$, twice as long as snout, which has a lower median crest and is, as also the front, translucent in its dorsal part, above each eye a low crest. Upper jaw with its hinder end slightly dilated, surpassing the eye by the length of eye and snout. Praeopercular border oblique. Origin of dorsal slightly before origin of ventrals, which are situated before the middle of the length. Origin of anal slightly

behind end of dorsal, before the beginning of last $^1/_3$ of length, ending below adipose fin. Pectorals somewhat below middle of height, reaching on ventrals. Scales cycloid. Luminous organs divided by a black septum. A minute antorbital organ dorsally at the frontborder of the orbit; two operculars, the larger dorsal one somewhat below level of ventral margin of eye, the smaller lower one behind upper jaw. 3 branchiostegals. 5 PO, the 3 anterior ventrally in a series, the fourth quite outside the series above the third, the fifth lower down at the base of the ventral. The 2 PVO in a straight line above each other, the dorsal one about before the middle of the base of the pectoral, the ventral one nearly on the same level as the superior opercular and the fourth PO. PLO above and slightly before them, near lateral line. 5 VO between ventrals and anal, the second of them somewhat higher than the others, outside the series. 7 AO in two groups, the anterior group, above the anal, contains 5, the posterior group, far distant from the anal, contains 2 organs, the last of which is situated above the infracaudal luminous patch. 4 Prc, 3 anterior equidistant in a series behind that luminous patch, the fourth far distant in the end of the lateral line. VLO midway between ventral and lateral line. 3 SAO in an oblique line, with a shallow concavity looking forward, the lower one above the anus, quite near to it, above and somewhat behind it, the middle one, the uppermost more distant, near the lateral line. Pol near the lateral line between the anterior and posterior AO. A large supracaudal luminous patch above the infracaudal patch. Length 153 mm. [After Brauer, not seen by us].

Habitat: West Coast of Sumatra (614 M.). — Indic between Seychelles and Chagos archipelago. Pacific: Galapagos islands.

We are not sure that Brauer's indic specimens are identical with Garman's *M. luminosum* from Galapagos islands, as Garman counts D. 16; L. l. 35 and does not mention the posterior AO and the 3 anterior Prc.

5. **Neoscopelus** Johnson.

(Johnson, Proc. Zool. Soc. London, 1863, p. 44).

Subfusiform, rather robust. Scales cycloid, deciduous, their surface finely denticulated. Lateral line present. Head conical.

Snout rather long and distinctly depressed. Jaws equal. Gape of mouth oblique, nearly extending to vertical through hind-border of eye, superiorly bordered by intermaxillary, the maxillary, which is posteriorly much dilated, behind it. Origin of dorsal above that of ventrals, far before middle of body. Anal behind beginning of last $^1/_3$ of length, its posterior portion opposed to adipose fin. Long pectorals below middle of body, reaching to end of ventrals. Caudal forked. Small teeth in a band on jaws and vomer. Mucous membrane of mouth blackish. Luminous organs separate, on the head and between the mandibular branches. A luminous spot below each scale of the lower part of the body. Pseudobranchiae large. Gillrakers rather long and slender. Gillmembranes free from isthmus, slightly overlapping eachother at chin. Branchiostegals 8—9.

1. Neoscopelus macrolepidotus Johns.

Neoscopelus macrolepidotus Johnson, Proc. Zool. Soc. London 1863, p. 44.
Scopelus macrolepidotus Günther, Cat. Brit. Mus. V. 1864, p. 414.
Neoscopelus macrolepidotus Alcock, Descript. Catal. Indian Deep-Sea Fish. 1899, p. 164.
Neoscopelus macrolepidotus Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 147.
Neoscopelus macrolepidotus Max Weber, Siboga-Exp. Fische 1913, p. 83.

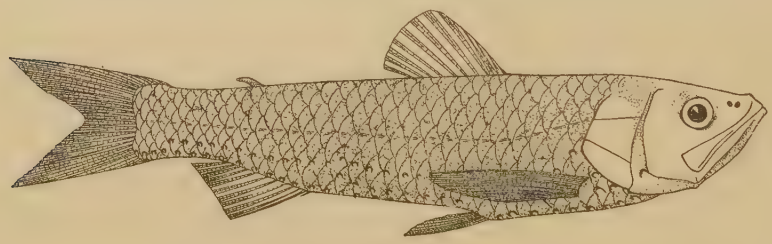

Fig. 67. *Neoscopelus macrolepidotus* Johns.

B. 8—9; D. 12—13; A. 11—13; P. 16—18; V. 8; L. l. 30—31; L. tr. $^3/_5$.

Height 4—$4^1/_2$, head 3—$3^2/_5$, eye $4^1/_2$ to more than 5, shorter than snout. Origin of dorsal nearly midway between end of snout and end of adipose fin. Origin of anal half a head-length behind last dorsal rays. Pectorals much longer than head. Luminous organs: one on the lower portion of the praeopercle, a few small ones on the gillmembrane. On each side ventrally on the tongue 8—9 smaller organs and behind them a large one,

which may be visible from below between the mandibular branches. 8—9 along each side of isthmus. A median series beginning with 3 smaller ones on isthmus followed by 14—17 to anus. A small one between urogenital papilla and 4—5 behind anal. On each side of anus a row of 4—5 small ones. A ventro-lateral series of 31—35 organs, beginning at the vertical through beginning of median series and running to the caudal. An inferior lateral series of 9—10 organs running from above-named vertical to ventrals. A superior lateral series of 22—25 organs extending from dorsal base of pectorals to somewhat behind the end of the anal. 3 large ones before base of pectorals, 3—4 smaller behind it, 2—3 small ones before base of ventrals. Besides there may be some scattered small ones. Reddish, back and belly darker. Head silvery. Fins red in fresh specimens. Length 240 mm.

Habitat: Madura Sea (289 M.)!; Bali Sea (538 M.)!; Flores Sea (521 M.)!; Timor Sea (709 M.)!; Arafura Sea (560 M.)!; West of Sumatra (614 M.). — Tropical Indic. Pacific: N. E. off New Sealand; Sandwich islands. Atlantic: Madeira, Morocco and West Indies.

6. Scopelosaurus Bleeker.

(Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Elfde Bijdr. Amboina p. 12).

Cylindrical, elongate. Eye large. Snout long and pointed. Lower jaw prominent. Gape of mouth wide, superiorly bordered by the intermaxilla, the long maxilla situated above it. Dorsal somewhat behind the middle and behind ventrals, far distant from anal. Anal in the beginning of the posterior $^1/_4$ of the length, immediately behind anus. Adipose fin above its hinder end. Pectorals in the middle of the height. Caudal forked. Immovable, small teeth in one series on intermaxillaries, palatines and vomer, in several series in the mandible. None on tongue. Mucous membrane of cavity of mouth blackish. Scales cycloid, wanting on head. Lateral line straight, composed of tubules. Three ventral series of luminous organs between isthmus and anal [1]). Pseudobranchiae present. Gillrakers rather long and slender. Four gills. 9 branchiostegal rays.

1) We could not make out on the type specimen, which is in a bad state of preservation, if the „guttulae numerosae argenteae nitentes in series 3 longitudinales dispositae", as mentioned by Bleeker, really are luminous organs.

1. Scopelosaurus Hoedti Blkr.

Scopelosaurus Hoedti Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Elfde Bijdr. Amboina, p. 13.
Scopelosaurus Hoedti Bleeker, Atl. Ichth. VI. livr. 27, 1875, p. 157.

Fig. 68. *Scopelosaurus Hoedti* Blkr. (after Bleeker).

B. 9; D. 2.8—9; A. 2.15—16; P. 2.11; V. 2.8; L. l. ± 61; L. tr. ± 8; 3($2^1/_2$) above L. l. below D.

Height circa $11^3/_4$, about as broad as high. Pointed head about 4. Eye $3^1/_3$, $^2/_3$ of interorbital space. Fronto-dorsal profile almost straight. Nostrils nearer to orbit than to snout, which is acute and slightly longer than eye. Upper jaw ending below posterior part of eye, twice in length of head. Praeoperculum with an obtusely, rounded, nearly right angle. Operculum thin, translucent, slightly higher than long, inferiorly with a convex margin, superiorly divided by a longitudinal crest. Lower jaw prominent. Origin of dorsal about in the middle between eye and caudal, slightly behind ventrals, much higher than the length of its base and slightly higher than body; acute, not emarginate. Adipose fin slender, oblong, pointed, opposite to posterior rays of anal. Anal as long as or slightly shorter than postocular part of head, longer than high, acute, emarginate. Pectorals acute, conspicuously shorter than head without snout, not reaching ventrals. Ventrals much shorter than pectorals, nearer to head than to anal. Caudal deeply incised, with the lobes acute and subequal. Small teeth in the intermaxillary in one series, in the mandible in several series, the vomerine teeth in a transverse series, those in the palatines in a long series. Scales cycloid, those on the tail smaller, none on head. Lateral line nearly straight. Luminous organs (?) in 3 longitudinal ventral series. Length of single specimen known 151 mm. [Type in the Leyden Museum seen by us].

Habitat: Ambon!

In sea.

7. Chlorophthalmus Bonaparte.

(Bonaparte, Fauna Italiana Fasc. XXVIII, Pesci, 1840).

Rather elongate and compressed behind. Head rather long, pointed and somewhat depressed. Mandible protruding beyond snout. Cleft of mouth slightly oblique, bordered above by the intermaxillary, the maxillary, which is posteriorly dilated, lying above it; a single supplemental bone present. Eyes large, lateral. Scales moderate, adherent, cycloid, ctenoid or even pectinated, arranged in regular transverse rows, overlapping in such a manner as to resemble oblique plates upon the sides. Lateral line present. Dorsal surface of head naked. Dorsal short, its origin before middle. Anal short, opposite to adipose fin, situated far behind anus, which is near the ventrals. These are close together and below dorsal. Pectorals lateral, well developed. Caudal forked. Minute, pointed teeth in narrow bands on the jaws, palatines and in two separate patches on the vomer; usually minute teeth on the tongue. Gillopening very wide, gillmembranes free. 8—10 branchiostegals. Pseudobranchiae well developed. Gillrakers rather numerous, needle-shaped. 4 gills.

Deep-sea fishes.

Synopsis of the species.

I. Pectorals about as long as head. Adipose fin as far behind dorsal, as the dorsal is behind the anterior edge of the eye . . . . . *Ch. productus* p. 177.

II. Pectorals nearly equal to head without snout. Adipose fin as far behind dorsal, as the dorsal is behind the anterior edge of the pupil . . . . . *Ch. corniger* p. 178.

1. Chlorophthalmus productus Gthr.

Chlorophthalmus productus Günther, Challenger Rep. XXII, Deep-sea Fishes, 1887, p. 193.

Chlorophthalmus productus Max Weber, Siboga-Exp. Fische, 1913, p. 79.

B. 8; D. 11; A. 10; P. 16; V. 9; L. l. 56—58; L. tr. 8—9.

Height $5^3/_5$, head $3—3^1/_3$, eye $2^2/_3$, longer than snout, about 4 times in the interorbital space. Upper jaw dilated posteriorly, extending to vertical through anterior margin of pupil. Lower jaw prominent, forming a strongly projecting, transverse, horizontal plate, the anterior margin of which is strongly

denticulated, superiorly covered by small teeth. Origin of dorsal far before middle of length, in the second $^1/_3$ of length, slightly before ventrals, which are also situated before the middle. Anal in the last $^1/_3$ of the length. Adipose fin above anal, as far behind dorsal as the dorsal is behind the anterior edge

Fig. 69. *Chlorophthalmus productus* Gthr.

of the eye. Pectorals about as long as head. Caudal bifurcated. Anus behind ventrals and slightly behind middle of length. Scales posteriorly roughly dentated. Minute teeth in narrow bands in the jaws, on each side on the vomer and in a long stripe on the palatines and very minute ones scattered on the tongue. Gillrakers long, slender, finely denticulated, the longest longer than branchial filaments. Yellowish with a faint silvery hue. Belly brownish, as also the back, from where indistinct brownish blotches descend ventrally. Fins dusky. Length 130 m.m.

Habitat: Madura Sea (289 M.)! — Pacific off Matuku, Fidji Islands.

2. Chlorophthalmus corniger Alcock.

Chlorophthalmus corniger Alcock, Journ. Asiat. Soc. Bengal, LXIII. 1894, p. 133. — Descript. Cat. Indian Deep-sea Fishes, 1899, p. 155.
Chlorophthalmus corniger Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 145.

B. 8; D. 11; A. 9; P. 14—15; V. 9; L. l. 56—59.

Height $4^3/_5$—$5^3/_5$, head 3—$3^1/_5$, eye $2^1/_2$ to nearly 3, longer than snout, about 3 times the interorbital space. Upper jaw dilated posteriorly, extending to vertical through anterior margin of pupil. Lower jaw prominent, forming a strongly projecting transverse horizontal plate, the margin of which carries small teeth directed forward and downward. Origin of dorsal before the middle, in the second $^1/_3$ of length, slightly before ven-

trals, which are also situated before the middle. Anal in the last $^1/_3$ of length. Adipose fin as far behind the dorsal as the dorsal is behind the anterior edge of the pupil, situated above the anal. Pectorals nearly equal to head without snout, nearly reaching to end of ventrals. Caudal bifurcated. Anus somewhat behind ventrals and behind middle of length. Scales posteriorly roughly dentated. Minute teeth in narrow bands on the jaws, on each side on the vomer and in a long stripe on the palatines and very minute ones scattered on the tongue. Long closely set, bristle-like gillrakers, in large specimens longer than branchial filaments. Silvery grey, with dusky, oblique crossbands and dorsally with large irregular blackish spots. Fins hyaline. Tip of dorsal and caudal and median portion of ventrals black. Length over 200 m.m. [Not seen by us].

Habitat: West Coast of Sumatra (371 M.). Tropical Indic.

8. Ipnops Günther.

(Günther Ann. Mag. Nat. Hist. II. 1878, p. 187. — Rep. Challenger-Exp. Deep-sea Fishes, XXII. 1887, p. 190).

Body elongate, subcylindrical, covered with large thin deciduous scales, and without luminous organs. Head depressed, with broad, long, spatulate snout, the whole upper surface of which is occupied by a pair of large, transparent, lamelliform membrane bones, which cover a luminous organ, longitudinally divided into two symmetrical halves. Eyes absent; nostril reduced to a minute opening in front of each lamina. Bones of the lower and lateral parts of the head well ossified. Mouth wide, with the lower jaw projecting; maxillary dilated behind. Both jaws with narrow bands of villiform teeth; palate toothless. Pectoral and ventral fins well developed, and, owing to the shortness of the trunk, close together. Dorsal fin at a short distance behind the vent; adipose fin absent; anal fin moderately long; caudal subtruncated. Pseudobranchiae absent; airbladder absent; pyloric appendages absent.

1. Ipnops murrayi Gthr.

Ipnops murrayi Günther, Ann. Mag. Nat. Hist. II. 1878, p. 187. — Rep. Challenger Exp. Deep-sea Fishes, XXII. 1887, p. 191.

B. 12; D. 10; A. 13; P. 14; V. 8; L. lat. 55.

Body elongate, cylindrical, tail compressed behind, head

depressed. The depth of the trunk diminishes but little backwards, and is contained thirteen and a half times in the total length without caudal; the length of the head is one-sixth of the total. Head broad, much broader than deep, its greatest depth being two-thirds of its length. Snout broad, much depressed, with obtusely rounded anterior profile; cleft of the mouth very wide, the maxillary moderately dilated behind and exten-

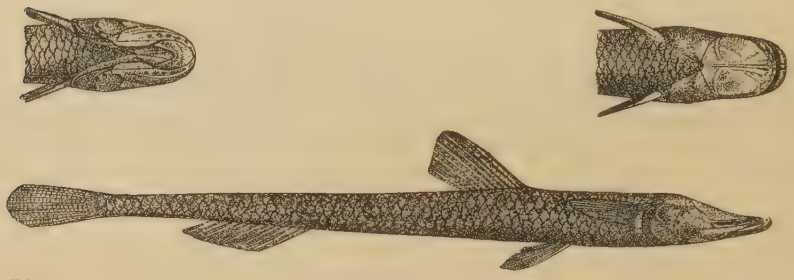

Fig. 70. *Ipnops murrayi* Gthr. Head from above and below (after Günther).

ding beyond the middle of the length of the head. Mandible projecting beyond the upper jaw, broad, but owing to the depressed form of the snout its outer surface is nearly entirely at the lower side of the snout. Infraorbital chain of bones very narrow, wedged in between the transparent lamina and the maxillary, with four very distinct apertures leading into the mucous duct. The upper surface of the head, including the snout, is wholly covered by the two cornea-like laminae of the luminous apparatus. They are closely attached to each other along the median line, each being divided by a shallow transverse ridge into a larger anterior and a smaller posterior portion. The ridge turns forward near and parallel to, the median line, and marks the course of a superficial mucous duct. The gill-laminae are well developed and the gillrakers long, needle-shaped, closely set, about twenty-two in number on the outer branchial arch.

The vent is nearly twice as distant from the root of the caudal fin as from the end of the snout, and rather more than the length of the head from the gill-opening; it is placed between the ventral fins. The dorsal fin commences immediately behind the vertical from the vent; it is short, but its longest rays are twice as high as the body. Origin of the anal midway between the vent and the root of the caudal,

composed of rays, which are still more slender and shorter than those of the dorsal. Caudal fin narrow, subtruncated, more than half as long as the head. Pectorals rather feeble, lateral, as long as the caudal, and extending to the ventrals. Ventrals composed of stronger rays, horizontally placed and somewhat distant from each other, as is frequently found in fishes habitually moving on the bottom; they slightly exceed the pectorals in length. The scales are large, thin, deciduous, forming only six longitudinal series on each side of the trunk. Lateral line faintly indicated along the middle of the body; the muciferous channels on the head are also narrow, with small apertures. Brown, with colourless fins. Buccal and branchial cavities and the lower side of the head black. Length 137 mm. [After Günther; not seen by us].

Habitat: Banda Sea (3932 M.). — South Atlantic.

9. Dissomma Brauer.

(Brauer, Zool. Anz. XXV. 1902, p. 278).

Elongate, strongly compressed, snout conical, gape of mouth wide. Probably small scales (no fullgrown specimens known). Telescopic eyes laterally situated, but looking upwards. The short dorsal before ventrals, which are situated before middle of length. Anal long, behind middle of body, above its hinder-half the rather high adipose fin. Caudal forked. Intermaxillary large. Maxilla, if present, very small. Teeth on intermaxillaries, mandibles, vomer, palatines and tongue, depressible, unequal in size. Gillopening wide. Gillmembranes separate. Pseudobranchiae present. 4 gills. Gillrakers small. No luminous organs.

1. Dissomma anale Br.

Dissoma anale Brauer, Deutsche Tiefsee-Exp. Tiefseefische, 1906, p. 138.
Dissoma anale Max Weber, Siboga-Exp. Fische, 1913, p. 84.

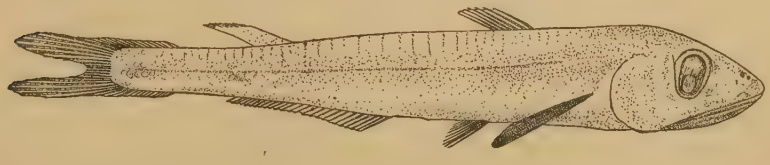

Fig. 71. *Dissoma anale* Brauer (after Brauer).

B. 8; D. 7; A. 25; P. 19; V. 9.

Height $6^1/_2$, head $4^1/_5$, eye $3^1/_2$, about $^2/_3$ of snout, which

is conically pointed and slightly prominent. Nostrils much nearer to point of snout than to eye. Gape of mouth extending to vertical through posterior border of eye. For situation of fins see the diagnosis of the genus. Pectorals broad and long, reaching farther than the vertical through origin of ventrals. Ventrals not reaching the anus. Small teeth in intermaxillary, mandible with 3 smaller anterior ones, behind them 4 large ones, a few large ones on vomer and on palatines, 4—6 large ones in a series on tongue. Reddish brown. Length 29 mm.

Habitat: Banda Sea (1500—0 M. vertical net)! — Indic: North of Cocos islands; near Port Elisabeth. East Atlantic between Canarian islands and Bouvet-islands (Antarctic).

10. **Evermannella** Fowler.

(Fowler, Proc. Acad. Nat. Sci. Philad. LIII. 1901, p. 211).

Odontostomus Cocco (name preoccupied).

Oblong, compressed, naked. Head large, snout short, gape of mouth very wide, bordered by the slender intermaxillary, above which lies the slender maxillary. Eyes large, telescopic, their long axes nearly vertical and parallel, only their superior part is not covered by transparent skin. Origin of short dorsal slightly before that of ventrals, in the middle or in the anterior half of the body. Anal long, its origin behind middle. Adipose fin small, above end of anal. Pectorals near the ventral profile. Caudal forked. Intermaxillary with series of small curved teeth of equal size as also in the posterior part of the lower jaw; in its anterior part and on the vomer and palatines depressible, long, fang-like teeth. 8 branchiostegals. Pseudobranchiae present. No gillrakers. Gillopenings wide. 4 gills.

1. **Evermannella indica** Br.

Evermannella indica Brauer, Deutsche Tiefsee-Exp. Tiefseefische 1906, p. 135.
Evermannella indica Max Weber, Siboga-Exp. Fische 1913, p. 83.

D. 11—13; A. 28—29; P. 12; V. 9.

Height 6—$6^4/_5$, head 4, eye about $3^1/_2$, less than snout. Gape of mouth surpassing hindborder of eye. Origin of dorsal before that of ventrals, before middle of body, its end nearly above the vent or in the middle of the length. Origin of anal behind middle of body, before end of second $^1/_3$ of length, reaching close to the ventral rays of the caudal. Pectorals

reaching ventrals. Intermaxillary with about 10 small curved teeth. Mandible with a pair of small symphysial teeth; on each branch 2 distant, very large, curved teeth and a smaller one in front of the second, as well as one far back behind it, and one between this last and the second. One large tooth

Fig. 72. *Evermannella indica* Brauer.

on the vomer and 3—4 smaller ones on the palatines, though also large. Light brown, with a dorsal series of dark spots. An incomplete ventral one on the tail. Length 32 mm.

Habitat: Banda Sea (750—0 M., vertical net)! — Tropical Indic.

11. Promacheon M. Weber.

(Max Weber, Siboga-Exp. Fische 1913, p. 84).

Oblong, head large, conically pointed. Gape of mouth wide, nearly horizontal, dorsally formed by the intermaxilla, the slender maxillary lying above it. No barbel. Origin of dorsal behind middle of length and slightly behind ventrals. Anal longer than dorsal, beginning below middle of dorsal, its end below end of the adipose fin. Pectorals below middle of height. Ventrals about in the middle between pectorals and anus, which is situated immediately before anal. Caudal incised. Scales at least in the lateral line. Larger and smaller teeth in the jaws. No teeth on palate? Point of each intermaxilla with a triangular, prominent tooth, directed forward and slightly downward. No luminous organs. Stomach and abdomen not extensible. Gillmembranes free from isthmus, connected behind symphysis. 6 short branchiostegal rays.

The types are 2 specimens, so juvenile, that the myocommata and fin-muscles are visible through the skin.

1. Promacheon sibogae M. Web.

Promacheon sibogae Max Weber, Siboga-Exp. Fische 1913, p. 85.

B. 6; D. 14; A. 17—18; P. 15; V. 10; L. l. circa 32.

Oblong, height $3^1/_2$, head 3, eye 6, more than twice shorter

than snout, the profile of which is oblique. Praeopercular margin slightly oblique and its lower angle with a spine. Intermaxilla, besides the anterior prominent tooth, with a series

Fig. 73. *Promacheon sibogae* M. Web. × 4.8.
Upper figure: jaw with translucent part of maxillary a × 20;
lower figure: tip of snout from above × 4.8.

of larger teeth partly curved and directed backward and smaller ones between them. Both kinds are smaller in the mandible. Length about 20 mm.

Habitat: Banda Sea (0—2000 M. vertical net)!

Order OSTARIOPHYSI Sagemehl.

Physostome. Scaly or naked, lateral line present or absent. Skull with a supraoccipital, separated from the frontals by parietals, which are distinct or fused with the supraoccipital. Upper jaw formed by intermaxillare and maxillare, or by the first alone, the maxillare being reduced. Opercle complete or

lacking suboperculum and sometimes operculum. The anterior four vertebrae modified and often co-ossified. Their ribs and neural arch forming a chain of bones connecting the air-bladder with the auditory organ (Weberian ossicles). Pectoral arch suspended from the skull. Mesocoracoid generally present. Fin-rays articulated, the dorsal and pectorals sometimes with a spine. Pectorals inserted low down, folding like the ventrals, which are abdominal, by exception absent.

1. Suborder **Siluroidea.**

(Nematognathi Gill).

Skin naked or with bony scutes or plates, never with scales. Parietals generally united with supraoccipital. Mouth not protractile, superiorly bordered by the intermaxillary, which is generally toothed, the maxillary being reduced, nearly always toothless, bearing a barbel. Nearly always 1—4 pairs of barbels. Adipose fin generally present. Symplectic and suboperculum absent. Vomer and pterygoids usually with teeth. Pharyngeal bones with small conical or villiform teeth. Branchiostegal rays 4—17. No pseudobranchiae. Anterior vertebrae co-ossified. Ribs attached to the lower surface of long parapophyses. Fin-rays articulated, the second dorsal ray and the exterior pectoral ray generally transformed into spines by co-ossification of their segments. Lateral line may be ramified.

Artificial key to the families.

I. Dorsal spineless. Anal very long.
  A. Dorsal many-rayed, 4 pair of barbels. . . . . *Clariidae* p. 186.
  B. Dorsal very short, rudimentary or absent, 2 pair of barbels . . . . . *Siluridae* p. 195.

II. Dorsal with a pungent spine.
  A. Caudal pointed, united with the socalled second dorsal or procurrent caudodorsal.
    1. Anal long, united with caudal. Ventrals with 10—12 rays. . . . . *Plotosidae* p. 223.
    2. Anal short, free from caudal. Ventrals with 6 rays. *Chacidae* p. 245.
  B. Caudal forked, emarginate or truncate, without any procurrent part.
    1. Anal long with 28—40 rays. Gillmembranes free from isthmus.

a. Gape of mouth small; a free orbital margin; adipose fin very small; nasal barbel present or absent . . . . . *Pangasidae* p. 246.

b. Gape of mouth very large; no free orbital margin; adipose fin well developed; no nasal barbel. *Doiichthyidae* p. 333.

2. Anal short. Adipose fin well developed, only totally wanting in *Breitensteinia.*

a. Nostrils close together, separated by a nasal barbel. Gillmembranes confluent with isthmus or free . . . . . *Bagaridae* p. 262.

b. Nostrils close together, separated by a valve without nasal barbel. Gillmembranes connected with isthmus . . . . . *Ariidae* p. 271.

c. Nostrils remote from each other, the posterior with a nasal barbel.

α. Teeth on the palate. Gillmembranes free from isthmus . . . . . *Bagridae* p. 335.

β. Palate edentulous; Gillmembranes united with isthmus . . . . . *Akysidae* p. 365.

Note: *Pimelodus javus* shortly described by CUVIER & VALENCIENNES (Hist. nat. des Poissons XV, 1840, p. 187) after a specimen said to be from Java, is brought by BLEEKER (Atl. ichth. II. 1862, p. 61), with two queries, under the american genus *Rhamdia.* He says never to have seen in Java a species like it and as according to him, the type in the Leyden Museum is lost, it is impossible to make out what *Pimelodus javus* C. V. is.

There is therefore no reason to believe that the american family of the *Pimelodidae* is represented in the Indo-australian Archipelago.

1. Fam. **Clariidae.**

Body elongate. Head much depressed. Its upper and lateral parts covered with osseous plates, forming a cask covering a diverticulum of the gill-cavity, containing accessory dendritic branchial organs attached to the second and fourth branchial arches. Cranial roof with an occipital and frontal fontanel, its occipital part prolonged in a process. Mouth transverse, terminal. Four pairs of barbels: nasal, maxillary, mandibulary and mental. Anterior nostrils short tubes behind the upper lip; posterior nostrils more or less rounded slits behind the

nasal barbels. Eyes small, with free orbital margin. A long dorsal and anal, composed entirely of soft rays, extending nearly to the caudal or united with it (*Clarias*), or the dorsal is shorter and followed by an adipose fin (*Heterobranchus*). Ventrals with 6 rays, pectorals with the outer ray spinous. Jaws with more or less united patches of villiform teeth. Vomer with a crescentic band of similar teeth. Gillmembranes shortly united, deeply notched in the middle, free from isthmus. Gillrakers 13—19 (in *Clarias*). Branchiostegals 7—9.

A. No adipose fin, dorsal nearly reaching caudal or united with it. . . . . *Clarias* p. 187.

B. An adipose fin posterior to the dorsal . . . . . *Heterobranchus* p. 194.

1. Clarias Gronovius.

(Gronovius Zoophyl. 1781. p. 100).

For characters of the genus, see those of the family.

Freshwater fishes of Africa, Syria, Southern Asia and East Indian Archipelago.

Fig. 74. *Clarias batrachus* (L.).

Synopsis of the species.

A. Pectoral spine with more or less vertical, strong teeth at its frontmargin . . . . . *C. melanoderma* p. 188.

B. Pectoral spine smooth, rough or with few not very prominent serratures

1. Dorsal and anal united with the caudal at least with its base . . . . . *C. nieuhofi* p. 189.

2. Median fins not united.

a. occipital process triangular, its top more or less blunt, its height about twice in its base, anterior border of frontal fontanel reaches to a line through the middle of eyes or farther forward.

α. distance between dorsal and occipital process $4^1/_2$—$5^1/_2$ in distance from lastnamed to snout; length of head to occipital process $3^1/_2$—$3^2/_3$ in length (without caudal) . . *C. batrachus*. p. 190.

β. distance between dorsal and occipital process about $2^1/_2$ in distance from lastnamed to snout; length of head to occipital process 4—5 in length (without caudal). *C. teysmanni* p. 191.

b. occipital process triangular, its top rounded, its height nearly three times in its base, anterior border of frontal fontanel nearly reaches a line through the hindborder of the eyes. . . . . *C. leiacanthus* p. 192.

1. Clarias melanoderma Blkr.

Clarias meladerma Bleeker, Nat. Geneesk. Arch. Ned.-Ind. III. (2). 1846, p. 178, 288; Verh. Bat. Gen. XXI. I. 1847. Silur. batav. consp. diagn. p. 44.
Clarias melasoma Bleeker, Nat. Tijdschr. Ned.-Ind. III. 1852, p. 427.
Clarias melanoderma et *melanosoma* Bleeker, Act. Soc. Sc. Indo-Neerl. v. 1858—1859, p. 1.
Clarias melanoderma Bleeker, Atl. Ichth. II. 1862, p. 102.
Clarias melanoderma Günther, Cat. Brit. Mus. v. 1864, p. 19.
Clarias melanoderma Vinciguerra, Ann. Mus. Civ. Genova, XIV. 1879, p. 386.
Clarias melanoderma Volz, Zool. Jahrb. Abth. Syst. XIX. 1903, p. 381.

B. 8—9; D. 68—72; A. 52—61; P. I. 9; V. 6.

Elongate. Height $5^1/_2$—7, head (to gillopening) 5—$5^3/_4$, 4—$4^1/_4$ measured to the occipital process. Head as long as broad, its greatest breadth above opercles. Head flat, dorsal profile slightly sloping down. Head granular above. Occipital process very obtuse and very broad at base and very little prominent. Frontal fontanel longer than the occipital one, its frontborder behind the eyes. Eyes 10—12. Eye-distance nearly equalling the mouthopening, about $1^1/_2$—$1^3/_4$ in head. Nasal barbels reach dorsal, maxillary ones surpass pectorals and may even extend to the ventrals, mandibulary barbels extending to the top of the pectorals or nearly so; mental barbels somewhat shorter. Distance between first dorsal and occipital process equalling $^1/_6$ of the distance of lastnamed to the snout. Dorsal and anal or both may be united in exceptional cases with the base of the rounded caudal. Ventrals rounded, reaching on anal, about $^2/_3$ of length of pectorals. Pectorals rounded, conspicuously longer than head without snout, their spine very strong, about $^1/_4$ shorter than the longest rays, with

very prominent strong spines on its frontborder. Gillrakers 15, with 2 very short ones anteriorly, a little shorter than branchial filaments. Teeth small, sharply pointed. Maxillary teeth in two more or less confluent patches, which are very little curved and four times as broad as long. Mandibulary teeth in two contiguous, quadrangular patches with the posterior, exterior corner laterally produced. Vomerine teeth in a crescentic band. Uniform blackish, underside of head and belly a little lighter, sometimes with lighter spots. Length about 340 mm.

Nomen indig.: Wiru (Mal. Batav.), Leleh and Duri (Palemb.).

Habitat: Java (Batavia, Kediri); Sumatra (Palembang!, Telokbetong, Solok, Taluk! Gunung Sahilan! Kaju tanam, Upper and Lower Langkat, Serdang!, Lake Toba!, Djambi!; Borneo (rivers Kusan and Kapuas). — Philippines, Siam, China.

2. Clarias nieuhofi C. V.

Clarias nieuhofii Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 386.
Clarias pentapterus Bleeker, Nat. Tijdschr. Ned.-Ind. II. 1851, p. 206.
Clarias Nieuhofii Bleeker, Atl. Ichth. II. 1862, p. 105.
Clarias nieuhofii Günther, Cat. Brit. Mus. v. 1864, p. 20. (see syn.).
Clarias Nieuhofii Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 166.

B. 8—9; D. 87—106; A. 69—95; P. I. 9; V. 5—6.

Very elongate. Height 8—9$^1/_3$, head measured in the ordinary way 7—9, measured to end of occipital process 5$^1/_2$—6$^1/_2$. Length of head to gillopening nearly equalling its greatest breadth, which is about midway between eye and opercular border. Its profile from the dorsal nearly flat. Occipital process not very prominent, triangular, its broad base nearly thrice as long as its height. Occipital and frontal fontanel nearly equal, the lastnamed far behind eyes. Eyes 11—15. Eye-distance greater than mouthopening, less than twice in head. Nasal barbels nearly reaching or surpassing occipital fontanel, maxillary and mandibulary barbels nearly or quite reaching to tip of pectorals, mental barbels extending on opercle. Head granular. Distance between dorsal and occipital process 2—3 times in distance from snout to end of occipital process. Bluntly rounded caudal more or less completely united with anal and dorsal. Ventrals rounded, extending on anal, about 3 times in length of head. Pectorals short, rounded, not reaching vertical through origin of

dorsal, $1^3/_4$—2 times in length of head. Pectoral spine rather weak, $^2/_3$ of longest pectoral rays, rough. Teeth small, acute. The maxillary ones in two contiguous rectangular patches, broadening laterally, 2 times as broad as long. The mandibulary teeth in two contiguous quadrangular patches with the posterior, exterior corner laterally produced. The vomerine teeth in a semicrescentic band, the posterior border in its middle with a prominent point. 16 gillrakers, about as long as branchial filaments, nearly 2 times diameter of eye. Uniform dark, belly and underside of head whitish. Dark parts of body often with white spots, which are arranged in 13—20 transverse rows dorsally. Length 490 mm.

Nomen indig.: Lindi (Mal. Batav.), Lembat (Djambi).

Habitat: Java (Batavia, Buitenzorg!, Bekassi); Sumatra (Palembang!, Lahat, Gunung Sahilan!, Ringat!, Indragiri, Djambi!, Deli); Banka; Biliton; Borneo (rivers Mahakam!, Barito!, Kahajan, Kapuas, Sambas, Baram, Sarawak, Balikpapan!). — Malacca, Philippines.

3. **Clarias batrachus** (L.) [Fig. 74. p. 187].

Silurus Batrachus Linné, Syst. Naturae 1758, p. 305.
Silurus batrachus Bloch, Ausl. Fische VIII. 1794, p. 44.
Macropteronotus batrachus Lacépède, Hist. Nat. Poiss. v. 1803, p. 84.
Macropteronotus magur Hamilton Buchanan, Fishes Ganges, 1822, p. 146, 374.
Clarias batrachus Bleeker, Atl. Ichth. II. 1862, p. 103 (see syn.).
Clarias magur Günther, Cat. Brit. Mus. v. 1864, p. 17.
Clarias batrachus Kner, Novara Exp. Fische, 1865—1867, p. 299.
Clarias batrachus Peters, Monatsber. Akad. Wiss. Berlin 1868, p. 271. (see syn.).
Clarias magur Day, Fishes India 4°. 1878—1888, p. 485.
Chlarias batrachus Fowler, Proc. Acad. Nat. Sci. Philad. (2). LVII. 1905, p. 461.
Clarias magur Jordan & Seale, Proc. U. S. Nat. Mus. XXXIII. 1908, p. 535.

B. 7—9; D. 60—76; A. 47—58; P. I. 8—11; V. 6.
Elongate. Height 6—$7^1/_2$, head $4^2/_3$—5 to gillopening, $3^1/_2$—$3^2/_3$ to the top of the occipital process. Greatest breadth above opercles about equal to head. Occipital process triangular, its height about twice in its base, more blunt in old specimens. Occipital fontanel at least 2 times shorter than the frontal one, lastnamed extends to the middle of the eye or farther forward. Head granular. Eyes 9—14. Eye-distance greater than mouthopening, less than twice in head. Nasal barbels extend to occipital fontanel, equal to mental barbels;

maxillary barbels at least to middle of pectorals, mandibulary ones a little shorter. Distance between origin of dorsal and occipital process $4^1/_2$—$5^1/_2$ times in the distance from lastnamed to snout. Caudal rounded, not united with anal and dorsal. Ventrals rounded, extending on anal, about $^2/_3$ of pectorals. Pectorals rounded, about as long as head without snout, their spine more or less denticulated, as long as or longer than postorbital part of head. Villiform teeth in the maxillaries in two contiguous quadrangular patches, about twice as broad as long. Mandibulary teeth in two contiguous quadrangular patches, with the posterior, exterior corner laterally produced. Vomerine teeth in a crescentic band as broad as or narrower than the supermaxillary band, its hindborder more or less prominent in the middle. 16—19 gillrakers, the two anterior ones very short, shorter than branchial filaments. Dark above, belly and underside of head light. Sometimes transverse rows of light spots along the sides of body and tail. Length over 400 mm.

Nomen indig.: Ikan leleh (Malay, Sundan. and Javan.). Ikan maut (Gajo, Atjeh).

Habitat: Java (Batavia!, Bekassi, Tandjong-Oost, Tjampea, Buitenzorg!, Serang!, Bantam, Dano, Tjibilong, Perdana, Tjandjur, Tulong Agung, Tjipanas, Bandung, Situ Bagendit!, Tragan!, Cheribon, Samarang, Ambarawa, Wonosobo, Lesti, Ngantang, Bator, Grati, Palabuan, Lawang!, Djember!); Bali; Lombok!; Sumatra (Lahat, lakes Singkarah!, Manindjau! and Toba, Taluk! Solok! Fort de Kock, Pajakomboh, Upper-Langkat, Deli, Laut Tawar, Atjeh!); Simalur!; Singapore; Banka; Biliton; Borneo (rivers Mahakam, Barito, Kapuas, Sambas, Baram). — Philippines, Malacca, westwards to Burmah, British India and Ceylon. — Brackish and freshwater.

4. Clarias teysmanni Blkr.

Clarias Teysmanni Bleeker, Nat. Tijdschr. Ned.-Ind. XIII, 1857, p. 344.
Clarias Teysmanni Bleeker, Atl. Ichth. II. 1862, p. 104.
Clarias teysmanni Günther, Cat. Brit. Mus. v. 1864, p. 19.
Clarias Teysmanni Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 164.
Clarias Teysmanni Day, Fishes of India 4°. 1878—1888, p. 484.
Clarias Teysmanni Perugia, Ann. Mus. Civ. Genova, XXXIII. 1893, p. 243.
Clarias Teysmanni Vaillant, Nouv. Arch. Mus. Hist. Nat. (3). v. 1893, p. 62.
? *Clarias pulcher* Popta, Notes Leyden Mus. XXVII. 1906, p. 21 (mutilated specimen).

B. 9; D. 70—74; A. 60—63; P. I. 7—9. V. 6.

Elongate. Height 7—8, head to gillopening $5^1/_3$ to more than 6, head to occipital process 4—5. Greatest breadth above opercles about equal to head. Occipital process triangular. Its height about twice in its base. Occipital fontanel conspicuously shorter than the frontal one; lastnamed extends to the frontborder of the eye. Eyes 10—11. Eye distance conspicuously more than mouthopening, equalling postorbital part of head. Nasal barbels extend to occipital process. Maxillary barbels reaching pectorals or surpassing them. Mandibulary and mental barbels considerably shorter. Distance between origin of dorsal and occipital process $2^1/_2$ times in the distance from lastnamed to snout. Caudal rounded, not united with anal and dorsal. Ventrals rounded, extending on anal, $^2/_3$ of pectorals. Pectorals rounded, equalling head without snout or a little longer, their spine weak, very short, about $^1/_2$—$^2/_3$ of pectorals, much shorter than postorbital part of head (to gillopening), their frontborder a little rough. Teeth in the maxillaries in two contiguous quadrangular patches, about twice as broad as long, mandibulary teeth in two contiguous quadrangular patches, with the posterior corner laterally produced. Vomerine teeth in a crescentic band, its hind border sometimes more or less prominent in the middle. About 16 gillrakers, shorter than branchial filaments. Dark, underside of head and belly lighter. Body and tail with light spots, dorsally arranged in transverse rows. Median fins with a lighter border. Length more than 200 mm.

Habitat: Java (Batavia (Brit. mus.) Buitenzorg!, Tjikoppo, Pondok gedeh, Kadu); Sumatra (lake Toba!, Indragiri, Lahat); Singkep!; Borneo (rivers Kapuas, Sambas, Serawak, Riko)!. — Malacca, Ceylon.

5. Clarias leiacanthus Blkr.

Clarias leiacanthus Bleeker, Nat. Tijdschr. Ned.-Ind. II. 1851, p. 430. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 347. — Atl. Ichth. II. 1862, p. 104.
Clarias liacanthus Günther, Cat. Brit. Mus. v. 1864, p. 20.
Clarias liacanthus Vinciguerra, Ann. Mus. Civ. Genova XVI. 1880, p. 166.
Clarias liacanthus Steindachner, Abh. Senckenb. Ges. XXV. 1901, p. 443.
Chlarias leiacanthus Fowler, Proc. Acad. Nat. Sci. Philad. (2) LVII. 1905, p. 461.
Clarias liacanthus Popta, Notes Leyden Mus. XXVII. 1906, p. 18.

B. 9; D. 76—78; A. 60—62; P. I. 8—9; V. 6.

Elongate. Height 6—$6^4/_5$, head (to gillopening) $5^1/_3$—6, to

occipital process 4—5. Its greatest breadth midway between eyes and posterior part of opercles, equal to head. Eyes 12—14. Eye distance as long as or a little longer than mouthopening, nearly as long as head without snout. Occipital process triangular, its top rounded, not very prominent, its height nearly 3 times in its base. Occipital fontanel $^1/_3$ shorter than the frontal one, the frontborder of which reaches about a line through the hindborder of the eyes. Surface of head, if granular, very inconspicuously so. Nasal barbels extending to hindborder of head or surpassing it, maxillary barbel nearly reaching ventrals, mandibulary barbel extending to about the extremity of pectorals, mentals much shorter. Distance between origin of dorsal and occipital process $2^1/_2$ times in the distance from lastnamed to snout. The rounded caudal is free from dorsal and anal. Ventrals rounded extending on anal, $^2/_3$ length of pectorals, more than twice in head. Pectorals rounded, shorter than postorbital part of head, their spine not very strong, $^2/_3$ of longest rays, smooth. Teeth small, acute. In the maxillary arranged in two bands, broadened a little laterally, half as long as broad. The mandibulary teeth in two contiguous quadrangular patches, with the posterior exterior corner laterally produced. Vomerine teeth in a semicrescentic band. 13 gillrakers, shorter than branchial filaments. Uniform brown or blackish; belly, underside of head, barbels on underside, ventrals and pectorals whitish. Pectorals and barbels sometimes more or less dark coloured, body and tail often with light spots, more or less regularly arranged in transverse lines. Median fins more or less distinctly bordered with white. Length 330 mm.

Habitat: Sumatra (Benkulen, Ringat! Siboga, Djambi!); Banka; Nias; Borneo (rivers Kajan, Mahakam, Kahajan, Kapuas, Sambas, Sarawak, Baram and Balikpapan!).

Doubtful species.

1. *Clarias macrocephalus* Max Weber, Ergebn. einer Reise in N. O. Indien, Bd. III 1894. p. 419. (Pajakomboh, Sumatra).

The specifical value of the specimens named *C. macrocephalus* Gthr. by Max Weber is even now doubtful, as *Clarias macrocephalus* Gthr seems to be a rather doubtful species. The Pajakomboh specimens agree with *Cl. batrachus*, but are distinct by their long and strong pectoral spine, which is

of pectorals or farther. Pectorals a little more than once to $1^1/_2$ only a little shorter than the pectorals, and by their milk white colour, a little reddish in the fresh state.

2. *Clarias fuscus* Cuvier & Valenciennes, Hist. Nat. Poissons, XV. 1840. p. 383. (nec Lacépède). (Sumatra).

This species is too shortly described to make out its distinctive specifical characters.

3. *Clarias jagur* H. B. mentioned by von Martens, Exp. nach Ost-Asien, Zool. Bd. I. 1876. p. 302, 399, from Danau Sriang (Borneo), is probably *Clarias nieuhofii*, as *Clarias jagur* H. B. has never been recorded since.

2. Heterobranchus Geoffroy St. Hilaire.

(Geoffroy St. Hilaire, Descript. Egypte, Poissons 1809. p. 305).

For characters of the genus see those of the family.

Freshwater species, three from Africa and one from the Indo-australian Archipelago.

1. Heterobranchus tapeinopterus Blkr.

Heterobranchus tapeinopterus Bleeker, Nat. Tijdschr. Ned.-Indië III. 1852. p. 732. — Atl. Ichth. II. 1862. p. 101.

Heterobranchus tapeinopterus Günther, Cat. Brit. Mus. v. 1864. p. 22.

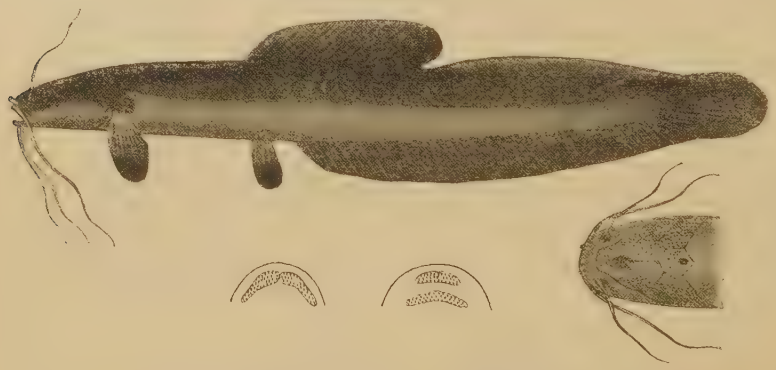

Fig. 75. Heterobranchus tapeinopterus Blkr.
Head from above, dentition of upper jaw and vomer and of lower jaw (After Bleeker).

B. 8; D. 24—27; A. 49—51; P. 1. 8; 8; V. 6.

Height $8—9^1/_2$, head measured to the operculum $5^2/_3—6^3/_4$. Eye 15—18. Nasal and mental barbels reaching to base of pectorals, maxillary and mandibulary barbels reaching to tip of pectorals or farther. Pectorals a little more than once to $1^1/_2$

in length of head, their spine distinctly serrated. The adipose fin is much lower but rather longer than the rayed dorsal; caudal united with adipose fin and with anal. Small teeth in the upperjaw in two juxtaposed patches, those of the lower jaw in two patches arranged in a curved band. Vomerine teeth in a broad, slightly curved band. Brownish. Length 124 mm.

Habitat: Banka; Borneo (Sambas, Serawak). [After Bleeker. Not seen by us].

2. Fam. Siluridae.

Elongate, more or less strongly compressed, head conical or with depressed snout, covered by skin. Eyes covered with skin, in *Wallago* only with a free orbital margin. A pair of maxillary and mandibulary barbels. Dorsal short, rudimentary or absent, without spine. No adipose fin. Anal long, manyrayed, ending near to caudal or more or less completely united with it. Caudal deeply and obliquely emarginate or rounded. Ventrals small, rudimentary or absent, below or behind dorsal. Pectorals with a spine. Teeth in *Belodontichthys* widely set and long, otherwise villiform in the jaws, on the vomer in one or two patches, none on the palatines. 9—20 branchiostegal rays, gillmembranes more or less overlapping, free from each other and from isthmus.

Key to the genera.

I. No ventrals . . . . . *Apodoglanis* p. 196.
II. Ventrals present.
1. Dorsal short but with at least 4 rays.
a. Caudal obliquely emarginate, broadly united with anal. Eye above corner of mouth . . . . . *Silurichthys* p. 197.
b. Caudal deeply forked, free from or but slightly united with anal.
α. Eye with free orbital margin, above the level of the corner of the mouth . . . . . *Wallago* p. 200.
β. Eye subcutaneous.
1. Teeth widely set, long; eye above the angle of mouth . . . . . *Belodontichthys* p. 203.
2. Teeth villiform, eye behind angle of mouth.
a. Vomerine teeth in one patch. . . . . *Silurodes* p. 204.
b. Vomerine teeth in 2 patches. . . . . *Callichrous.* p. 207.
2. Dorsal rudimentary or absent.
a. Posterior nostril above or behind frontmargin of eye. Vomerine teeth in 2 patches . . . . . *Hemisilurus* p. 210.
b. Posterior nostril before frontmargin of eye. Vomerine teeth (with one exception) in one band. . . *Cryptopterus* p. 215.

1. Apodoglanis Fowler.

(Fowler, Proc. Acad. Nat. Sc. Philadelphia 1905. p. 463.)

Elongate, caudal region the longest, strongly compressed, dorsal profile nearly straight. Head depressed, covered with soft skin. Eyes anterior and subcutaneous, above the corner of the mouth. Mouth broad with rather thick fleshy lips. Anterior nostrils near tip of snout. A long maxillary barbel behind anterior nostril, a shorter one on each mandible, remote from symphysis. Dorsal short, without spine, before anal. Long anal free from caudal, which is rounded. No ventrals in the only specimen known. Pectorals broad with a small spine. Teeth small and pointed, in broad bands in the jaws, those of the vomer in two small distant patches. Gillopening wide, gillmembranes free from isthmus and overlapping each other. Gillrakers short, sparse, pointed, slender, much shorter than branchial filaments.

1. Apodoglanis furnessi Fowler.

Apodoglanis furnessi Fowler, Proc. Acad. Nat. Sc. Philadelphia 1905. p. 463.

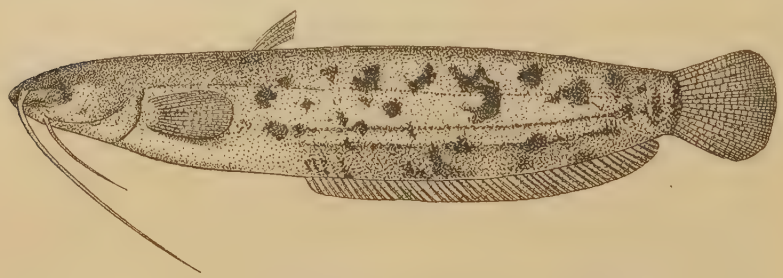

Fig. 76. *Apodoglanis furnessi* Fowler (after Fowler).

D. 4; A. 3, 47; P. 1. 10.

Height $4^3/_4$, head $4^3/_5$. Eye small. Maxillary barbel reaching beyond tip of depressed dorsal or a short distance beyond anterior anal rays. Length of pectorals $1^4/_7$ in that of head, its spine about $^2/_5$ of the fin. Brown, paler below, with irregular dusky blotches on back and base of anal.

Length of single specimen known 175 mm. (After Fowler; not seen by us).

Habitat: Borneo (Baram river).

2. Silurichthys Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 268).

Elongate, compressed, dorsal profile nearly straight, head rounded, covered by soft skin. Anterior nostrils tubular, above the frontborder of the snout, more approximated than the posterior nostrils, which are valvulated and looking upwards. Mouth terminal rounded, jaws nearly equal. Eyes subcutaneous, small, situated above the corner of the mouth. Four long barbels, two maxillary ones laterally from the anterior nostrils, an inferior one to each mandible. Dorsal very short, with 4 rays, without pungent spine, inserted above (or immediately before) the ventrals; no adipose fin. Anal confluent with caudal, which is obliquely emarginate, with the upperlobe the longer. Ventrals short with 7 rays. Pectorals with a spine. Small teeth in the jaws in bands, on the vomer in a single rounded patch. 9 branchiostegal rays. Gillmembranes free from isthmus and from each other, but slightly overlapping anteriorly.

1. Silurichthys phaiosoma (Blkr.).

Silurus phaiosoma Bleeker, Nat. Tijdschr. Ned.-Indië, II. 1851, p. 428.
Silurichthys phaiosoma Bleeker, Atl. Ichth. II. 1862, p. 81.
Silurichthys phaiosoma Günther, Cat. Brit. Mus. v. 1864, p. 35.
Silurichthys phaiosoma Max Weber & de Beaufort, In: Alfr. Maass: Durch Zentral-Sumatra, II. 1912, Fische p. 12.

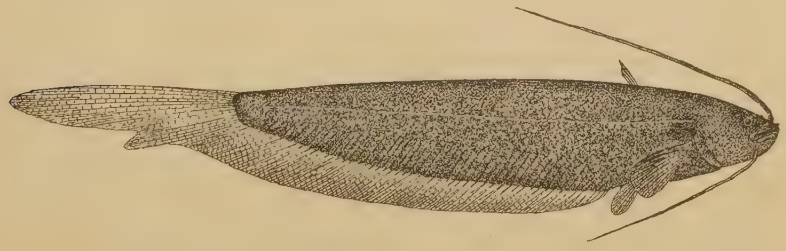

Fig. 77. *Silurichthys phaiosoma* (Blkr.).

B. 9; D. 4; A. 53—58; P. 1. 8—9; V. 7.

Elongate, strongly compressed, head rounded, dorsal profile nearly straight, sloping down to the flattened crown of head and snout. Upper jaw slightly prominent. Height 6—$6^1/_2$, head $6^1/_2$—$7^1/_4$. Eye about 6, subcutaneous, situated above the corner of the mouth, in the anterior half of the head, 3 times in the interorbital space. Anterior nostrils tubular, above the

frontborder of the snout, more approximated than the posterior nostrils, which are valvulated, looking upwards, near the vertical through the frontborder of the eye. Maxillary barbels laterally from anterior nostrils, extending to the middle of the anal. Mandibulary barbels at some distance behind symphysis, extending on the first $^1/_4$ of the anal. Origin of dorsal nearly opposite to ventrals; its height about equal to postorbital part of head. Anal confluent with caudal, which goes nearly $2^1/_2$ times in length of body, and is superficially and asymmetrically incised, with the lower lobe much shorter than the upper. Ventrals reaching on anal, $1^1/_2$ times in head. Pectorals about equal to head, their spine much shorter. Minute teeth in a curved band in the jaws, those of the vomer in one very small median patch. Brown above, distal part of caudal, of pectorals and anal somewhat darker, barbels sometimes with dark brown rings. Length 140 mm.

Habitat: Sumatra (Taluk! Bagan api api!); Singapore; Banka; Biliton; Borneo (Sambas, Kahajan, Danau Sriang, Sarawak). — Malacca.

In rivers.

Doubtful species.

1. Silurichthys hasseltii Blkr.

Silurichthys Hasseltii Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 270. — Atl. Ichth. II. 1862, p. 82.

Silurichthys Hasseltii Vaillant, Nouv. Arch. du Museum, (4) v. 1893, p. 62.

The type from Tjisekat, Java, examined by us in the Leyden Museum, differs from the preceding species by the more anterior position of the dorsal, which is situated in advance of the ventrals as also stated by Bleeker and by Vaillant. It is doubtful as is also expressed by Vaillant, that on this character alone a new species can be founded.

2. Silurichthys schneideri Volz.

Silurichthys Schneideri Volz, Revue Suisse Zool. XII. 1904, p. 463.

D. 4; A. 64; P. 1. 10; V. 7.

Height $6^1/_2$ times in total length (without caudal). Length of head $7^1/_3$ in same length. Upper and lower jaw equal. Gape of mouth reaches laterally nearly vertically below frontmargin of eye. The eye is small, its diameter only $^1/_7$ of total length

of head; it is situated at the boundary between the first and second $^1/_3$ of the head, shortest distance between eyes equal to half length of head. Maxillary barbel reaches nearly to the half of the length without caudal. Mandibulary barbel shorter, not reaching to end of pectorals but somewhat below the insertion of the ventrals. Length of pectorals equal to that of head. Pectoral spine half as long as the fin, posteriorly finely denticulated. Ventrals exactly vertically below dorsal, equal to the distance between hindmargin of eye and hindmargin of the branchial opening. Distance between tip of snout and origin of anal equal to $1^1/_2$ times height of body. Anal confluent with caudal. Caudal obliquely truncated, its superior longest rays slightly longer than the greatest height of body. Total length without caudal 16 cm. [After Volz].

Locality: Sumatra: Upperlangkat (Danau near Sukaranda).

The only differences from *S. phaiosoma* seem to be: A. 64 instead of A. 53—58 and that the gape of mouth only reaches below frontborder of eye and not to its middle.

3. Silurichthys indragiriensis Volz.

Silurichthys indragiriensis Volz, Revue Suisse Zool. XII. 1904, p. 464.

D. 4; A. 49; P. 1. 9; V. 7.

Height nearly 5 times in total length (without caudal). Head $6^1/_2$ times. Upper jaw nearly inconspicuously prominent. Cleft of mouth reaches vertically below middle of eye. Eye $^1/_8$ of length of head. Maxillary barbel reaching to middle of body without caudal; mandibulary barbel nearly to end of pectoral fin. Length of pectoral equal to head, its spine slightly less than $^1/_3$ of length of head and equal to snout. Dorsal slightly before ventrals. Ventrals about half as long as pectorals. Distance from tip of snout to anal equal to $1^1/_2$ times height of body. Anal and caudal connected. Height of dorsal equal to distance from hindmargin of eye to tip of snout. Dorsal profile straight, slightly sloping towards head and tail. Dark brown above, with irregular larger blackish spots, sides fainter, irregularly marmorated and speckled with dark. Dorsal light, with dark markings. Pectorals and ventrals light, the first with numerous black irregular spots, the latter with dark markings towards the base. Anal with light border,

otherwise, even as the caudal, brownish, darker marmorated, similar to the sides of the body. [After Volz, not seen by us].

Locality: One specimen, Kwantang river, near Djapura (Indragiri, Sumatra).

This species differs from *S. phaiosoma* in the less numerous dorsal rays (49 in stead of 53—58), the lesser height of the body (5 in stead of $6^1/_2$) and that in the single specimen known the ventral is slightly behind and not below dorsal. (see Max Weber & de Beaufort in Maass: „Durch Zentral Sumatra", II. 1912, Fische p. 13).

3. Wallago Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I Siluri 1858 p. 259 [1]).

Compressed, head broad, snout depressed; cleft of the mouth slightly ascending. Eye with a free orbital margin, above the level of the corner of the mouth. Nostrils remote from each other, the anterior one tubulated. A maxillary, and some distance behind the symphysis, a mandibulary pair of barbels. Dorsal fin very short, without spine and composed of 5 rays. No adipose fin. The long anal free from caudal, which is forked. Ventrals behind or below dorsal, with 10—11 rays. Pectorals with a spine. Teeth depressible, those in the jaws in a broad band, those on the vomer in two patches. Gillrakers very short and stiff. Gillmembranes free from each other and from the isthmus. Branchiostegals 15—20.

Fig. 78. *Wallago miostoma* Vaill.

Synopsis of the species.

1. Corner of mouth surpassing hindborder of eye, 21 gillrakers . . . . . *W. attu* p. 201.

1) This is the first diagnosis of the genus, although the name *Wallago* was used by Bleeker since 1851, but without description.

2. Corner of mouth reaches to the vertical through anterior border of eye, 9 gillrakers . . . . . *W. leeri* p. 202.
3. Corner of mouth reaches below frontpart of eye, 9 gillrakers . . . . . *W. miostoma* p. 202.

1. Wallago attu (Bl. Schn.).

Silurus attu Bloch, Schneider, Syst. Ichth. 1801, p. 378.
Silurus Mülleri Bleeker, Nat. Geneesk. Arch. Ned. Ind. III. (2), 1846, p. 289.
Wallago Mülleri Bleeker, Nat. Tijdschr. Ned.-Ind. III. 1852, p. 585.
Wallago Rusellii Bleeker, Verh. Bat. Gen. XXV. 1853. Nalez. Ichthyol. Fauna Bengalen p. 108.
Wallago attu Bleeker, Atl. Ichth. II. 1862, p. 79. (See Synon.).
Wallago attu Günther, Cat. Brit. Mus. v. 1864, p. 36.
Wallago attu Day, Fishes of India 4°. 1878—1888, p. 479.

B. 18—20; D. 1. 4; A. 86—93; P. 1. 13—14; V. 10.

Height 5—7, head $4^3/_5$—$4^1/_4$, eye $6^1/_2$—10, entirely above the mouthopening, its hindborder a little before the hindborder of the mouth. Interorbital space nearly 3 times in the convexity of the interorbital space, snout produced, spatulate, $2^3/_4$ in length of head. Profile descending obliquely from dorsal to snout in a more or less straight line. Lower jaw prominent. Maxillary barbels extending to the anterior part of the anal, mandibulary barbels about as long as snout. Height of dorsal more than length of postorbital part of head, its distance from the snout nearly $2^1/_2$ in its distance from the caudal. Anal not reaching to caudal, which is deeply incised. Ventrals behind the dorsal. Pectorals about $1^1/_2$ in length of head, their spine entire, feeble, their stiff part nearly as long as the postorbital part of the head. 21 very short gillrakers. In the jaws broad bands of depressible, pointed teeth, the posterior rows increasing in size, those on the vomer also depresible, in two oblique oval patches. Lateral line very conspicuous. Blackish above, margaritaceous below. Fins hyaline or more or less dusky. Length over 500 mm.

Nomen indig.: Limpok djambal, Tjaba, Tjangop (Mal. Batavia).

Habitat: Java (Batavia, Udjong Krawang, Udjong Tangerang, Gempol); Sumatra (Palembang!). — Siam, Burmah, British India and Ceylon.

In rivers.

2. Wallago leerii Blkr.

Wallago Leerii Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 427. — Atl. Ichth. II. 1862, p. 80.
Wallago Leerii Günther, Cat. Brit. Mus. V. 1864, p. 37.
Wallago Leerii Vaillant, Notes Leyden Mus. XXIV. 1902, p. 44.

B. 16—17; D. 1. 4; A. 67—73; P. 1. 14—15; V. 1. 9—10.

Height $4^3/_5$—5, head a little more or less than 4, eye 7—9, situated above the level of the angle of the mouth, its frontpart above that angle, about 5 in the convexity of the interorbital space. Snout produced, $2^1/_2$ times in head. Upper profile of head nearly straight, neck strongly ascending to dorsal. Maxillary barbel extending to the anterior part of anal. Mandibulary barbels about as long as the eye. Height of dorsal equal to head without snout, its distance from the end of the snout $1^3/_4$ in that from the caudal. Anal free from caudal, which is deeply incised, the upperlobe the longer. Ventrals situated a little behind dorsal, nearly half as long as pectorals, which are about $^2/_3$ of head. Pectoral spine not very strong, its stiff part about as long as snout. In the jaws broad bands of rather fine pointed, depressible teeth. Two oval patches of teeth on the vomer. 9 very short, stiff, widely set gillrakers. Brownish, clouded with lighter. Length 500 mm.

Nomen indig.: Tapa (Palembang).

Habitat: Sumatra (Palembang!); Banka; Borneo (Kahajan, Kapuas, Sambas, Serawak).

In rivers.

3. Wallago miostoma Vaill. [Fig. 78. p. 200].

Wallago miostoma Vaillant, Notes Leyden Mus. XXIV. 1902, p. 44.
Wallago nebulosus Vaillant, Notes Leyden Mus. XXIV. 1902, p. 46.
Ompok nebulosus Fowler, Proc. Acad. Nat. Sci. Philadelphia, 1905, p. 465.

B. 15—16 (13 Vaillant, 19 Fowler); D. 1. 4; A. 64—72; P. 1. 14—15; V. 1. 9—10.

Height $4^1/_2$—$4^4/_5$, head about 4, eye 10, situated above the level of the angle of the mouth, which is in the vertical through the anterior border of the eye, about $5^1/_2$ in the interorbital space. Snout $2^1/_2$ in head. Lower jaw prominent, anterior part of head flattish, hindpart ascending to the dorsal with a con-

vexity. Maxillary barbel reaching to the anterior $^1/_3$ of anal or farther, mandibulary barbel about as long as diameter of eye. Height of dorsal equal to head without snout. Distance from dorsal to snout about $1^3/_4$ in its distance from the caudal. Anal free from caudal, which is deeply incised. Ventrals below or a little in advance of origin of dorsal, about half as long as pectorals, the length of which equals the distance from the base of the maxillary barbel to hindborder of operculum. The stiff portion of their spine is rather strong and a little shorter than the postorbital part of the head. Broad bands of fine, pointed, depressible teeth in the jaws. Similar teeth on the vomer in two oblique oval patches. 9 very short, stiff gillrakers, the longest with a basal prong. Black brown, with lighter marmorations, belly and underside of head whitish in small specimens, which have more or less blackish fins. Length about 450 mm.

Nomen indig.: Tapa Rawang (Djambi).

Habitat: Sumatra (Djambi!); Borneo (rivers Kapuas!, Mahakam, Baram).

In rivers.

4. **Belodontichthys** Bleeker.

(Bleeker. Ichth. Arch. Ind. Prodr. I. Siluri, 1858. p. 266).

Compressed, especially the long tail. Short, compressed head, covered with skin, with prominent lower jaw. Its upper profile concave, the neck elevated. Anterior nostrils long tubes, the posterior nostrils, at some distance behind them, are short tubes; both are between frontborder of snout and eye. Eye above the angle of the mouth, covered by the skin. A long maxillary barbel between the anterior nostril and the corner of the mouth. A pair of very short mandibulary barbels far behind the chin. Dorsal rudimentary, without spine. No adipose fin. Anal very long, terminates close to the caudal, which is forked. Ventrals below the dorsal, small, composed of 9—10 rays. Pectorals very large, with a slender, smooth spine. The widely set, slender, more or less arrowed teeth of unequal size are in three series in the jaws, none on the palatines, those of the vomer in a single transverse series and very small. Gillmembranes separated, free from the isthmus.

1. Belodontichthys dinema (Blkr.).

Wallago dinema Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 202.
Belodontichthys macrochir Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 266. — Atl. Ichth. II. 1862, p. 80.
Belodontichthys macrochir Günther, Cat. Brit. Mus. V. 1864. p. 37.
Belodontichthys macrochir Vaillant, Nouv. Arch. Mus. Hist. Nat. (3). V. 1893. p. 64.

Fig. 79. *Belodontichthys dinema* (Blkr.).

B. 14—15; D. 4; A. 85—96; P. 1. 20—22; V. 9—10.

Height about $4^1/_2$—$5^1/_2$, head $4^1/_2$—$4^3/_4$, eye 5—$5^1/_2$. Maxillary barbels, the proximal part of which is rather stiff, extend to the ventrals or a little farther, the mandibulary shorter than the eye. Pectorals longer than the head. Upper lobe of caudal the longer. Silvery, back and upper surface of head brownish. Undersurface of head and belly light, fins hyaline. Dorsal and membrane of pectorals more or less blackish. Base of pectorals and caudal more or less dark. Length 550 mm.

Nomen indig.: Lais (Banjermassin).

Habitat: Sumatra (Palembang!, Djambi!); Borneo (Banjermassin, Kapuas). — Malacca and Siam.

In rivers.

5. Silurodes Bleeker.

(Bleeker. Ichth. Arch. Ind. Prodr. I Siluri 1858, p. 271).

Compressed, head broad, snout depressed; mouth oblique, eye behind its corner and partly below its level, visible from underneath. Lower jaw prominent. Eyes covered by skin. Nostrils remote from each other. A maxillary and at some distance behind symphysis a mandibulary pair of barbels. Dorsal fin very short, without spine and composed of 3—4 rays. No adipose fin. The long anal free from or connected with base of caudal, which is forked. Ventrals with 7—8 rays, below dorsal. Pectorals with a spine. Teeth depressible, in the jaws in a broad band, those in the vomer not

separated. Gillrakers 12 (those of *S. borneensis* unknown), closely set, a little shorter than branchial filaments. Branchiostegals 9—11. Gillmembranes free from each other and from isthmus.

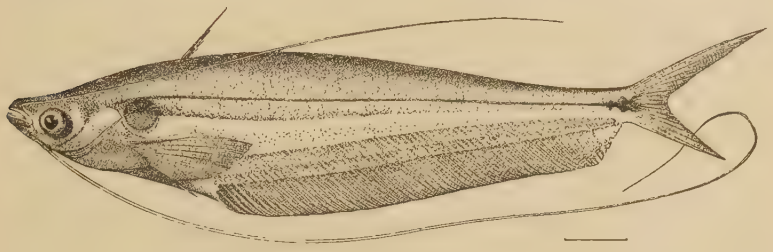

Fig. 80. *Silurodes eugeneiatus* (Vaill.).

Synopsis of the species.

I. Anal 76—82 . . . . . *S. hypophthalmus* p. 205.
II. Anal 53—59.
A. Anal connected with caudal, mandibulary barbels $5^1/_2$ in length . . . . . *S. borneensis* p. 206.
B. Anal free from caudal, mandibulary barbels surpassing caudal . . . . . *S. eugeneiatus* p. 207.

1. Silurodes hypophthalmus (Blkr.).

Silurus hypophthalmus Bleeker, Verh. Bat. Gen. XXI. I. 1847, p. 15.
Silurus macronema Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 203.
Silurodes hypophthalmus Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 272. — Atl Ichth. II. 1862, p. 83.
Silurodes macronema Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 273. — Atl. Ichth. II. 1862, p. 83.
Callichrous hypophthalmus Günther, Cat. Brit. Mus. V. 1864, p. 48.
Callichrous macronema Günther, Cat. Brit. Mus. V. 1864, p. 49.

B. 11; D. 3—4; A. 76—82; P. 1. 12—14; V. 7—8.

Height $4^1/_2$ to about 5, head $5^1/_5$—6, eye 4—5, visible from below, situated behind the corner of the mouth, about $3^1/_2$ times in the convexity of the interorbital space. Lower jaw more or less prominent. Upper profile with elevated neck, concave on the head. Maxillary barbels extending to about the middle of the anal, by exception even farther, mandibulary barbels shorter than the head. Height of very short dorsal equals about the length of head without snout. Anal

ceases shortly before the caudal, which is deeply incised; its lobes pointed, the upper one the longer. Ventrals very short, below dorsal. Pectorals about as long as the head, the osseous part of their spine as long as head without snout. Two patches of rather strong teeth on the vomer, arranged in two rows, which are connected in the middle by a single row. Rather strong pointed teeth, directed backwards in several rows in the jaws. 12 Gillrakers, the longest a little shorter than the branchial filaments. Upper part olivaceous, lower parts lighter, belly and underside of head white. A blackish spot behind the gill-opening, which may be prolonged in a dark lateral band, narrowing behind. A black spot at the end of the tail. Length over 300 mm.

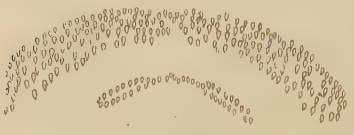

Fig. 81.
Silurodes hypophthalmus (Blkr.)
Teeth of upper jaw and palate × $2^1/_4$.

Nomen indig.: Limpok (Mal.), Lais (Lampong).

Habitat: Java (Batavia, Kediri); Sumatra (Palembang, Ringat!, Taluk!, Gunung Sahilan!, Djambi!, Lampong, Laut Tador, Indragiri, Upper Langkat, Deli); Borneo (Mahakam-river!, Sintang!, Danau Sriang).

In fresh water.

2. Silurodes borneensis (Steind.).

Callichrous borneensis Steindachner, Abh. Senckenb. Naturf. Ges. XXV. 1901, p. 445.

D. 4; A. 53; P. 1. 10; V. 7.

Height equal to head, about $5^1/_7$. Eye nearly 6, situated immediately behind the corner of the mouth. Lower jaw slightly projecting. Maxillary barbels 2 times, the very weak mandibulary barbels about $5^1/_2$ times in length. Height of dorsal about $1^1/_2$ in head. Last ray of anal totally connected with the caudal. Ventrals short, their longest lateral ray about $2^1/_2$ in head. Caudal as long as head, incised. Pectorals a little shorter than head, their spine rather strong, dentated at the hindborder, about $^3/_7$ of length of head. Vomerine teeth in an extremely narrow, linear, transverse band. Colour dark brown. No dark spot before caudal. [Not seen by us]. Length of single specimen known 84 mm.

Habitat: Borneo (Baram-river, Serawak).

3. Silurodes eugeneiatus (Vaill.). [Fig. 80. p. 205].

Callichrous eugeneiatus Vaillant, Bull. Soc. Zool. France XVIII. 1893, p. 61.
Callichrous eugeneiatus Vaillant, Nouv. Arch. Mus. Hist. Nat. (3) V. 1893. p. 65.
Silurodes eugeniatus M. Weber & de Beaufort, In: Maass: Durch Zentral-Sumatra, II. 1912. Fische p. 13.

B. 9; D. 4; A. 58—59; P. 1. 11; V. 7.

Height $3^3/_4$—$4^1/_2$, head $5^3/_4$, eye about 4, somewhat shorter than snout, visible from below, situated behind the corner of the mouth at a distance of $^1/_2$ eye-diameter, about twice in the convexity of the interorbital space. Upper profile obliquely descending from dorsal to snout, nearly straight, with a superficial concavity before the neck. Maxillary barbel extending to the posterior half of anal, mandibulary barbels surpassing the caudal. Dorsal with the first ray prolonged, as long as distance between corner of mouth and hindborder of head, its distance from the end of the snout about $2^1/_2$ times in its distance from the caudal. Anal slightly connected with the base of the caudal, which is deeply forked, its lobes pointed, the superior the longer. Ventrals short. Pectorals longer than head, the osseous part of the spine equals the head without snout and is rather strong. Small villiform teeth in a band on the jaws, a few small teeth in one oval patch on the vomer. 12 gillrakers, the longest a little shorter than the branchial filaments. Yellowish, back somewhat darker. A more or less dark spot behind the operculum, a smaller one before the caudal, both are connected by a dark lateral line. Length 165 mm.

Habitat: Sumatra (Djambi!, Gunung Sahilan!); Borneo (Knapei, Sebruang).

In rivers.

6. Callichrous Hamilton Buchanan.

(Hamilton Buchanan. Fishes of the Ganges 1822, p. 149).

Ompok Lacépède (diagnosis erronea).

Compressed, head broad, snout depressed. Cleft of mouth oblique, not surpassing the front edge of the eye, lower jaw prominent. Eyes covered by skin, their lower border on the level of the cleft of the mouth or a little below it. Nostrils remote from each other. A maxillary, and some distance be-

hind the symphysis, a mandibulary pair of barbels. Dorsal fin very short, without pungent spine, and composed of 4 rays. No adipose fin. The long anal free or connected with caudal, which is forked. Ventrals with 7—8 rays, below or a little before dorsal. Pectorals with a spine. Depressible teeth in the jaws in broad bands, those of the vomer in two separate patches. Gillrakers few in number, widely set, much shorter than branchial filaments. Branchiostegals 11—13. Gillmembranes free from each other and from isthmus.

Synopsis of the species.

1. Anal connected with base of caudal, head $5-5^2/_3$, A. 54–57.
   Mandibulary barbels nearly as long as the head . . . . *C. leiacanthus* p. 208.
2. Anal free from caudal, head $4^1/_2—4^3/_4$, A. 59—74.
   Mandibulary barbels a little longer or shorter than eye . *C. bimaculatus* p. 209.

1. Callichrous leiacanthus (Blkr.).

Wallago leiacanthus Bleeker, Nat. Tijdschr. Ned. Ind. V. 1853, p. 189.
Pseudosilurus leiacanthus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 281.
Callichrous leiacanthus Bleeker, Atl. Ichth. II. 1862, p. 85.
Callichrous liacanthus Günther, Cat. Brit. Mus. V. 1864, p. 47.
Callichrous liacanthus Vinciguerra, Ann. Mus. Civ. Genova XXI. 1880, p. 169.
? *Ompok jaynei* Fowler, Proc. Acad. Nat. Sc. Philadelphia, LVII. 1905, p. 466. (Baramriver, Borneo).

Fig. 82. *Callichrous leiacanthus* (Blkr.).

B. 11; D. 4; A. 54—57; P. 1. 12—13; V. 8.

Height $4^3/_4—5^1/_3$, head about $5—5^2/_3$, eye 6—7, at some distance above and behind the corner of the mouth, about $1^1/_2$ in snout, $3^1/_4—5$ in the interorbital space. Lower jaw the longer. Upper profile obliquely descending from dorsal to snout, neck somewhat elevated. Maxillary barbels extending

to the second $^1/_5$ of the anal, mandibulary barbels nearly as long as the head. Height of dorsal a little more than postorbital part of head, its distance from the snout about 2 times in its distance from the caudal. Last ray of anal connected with the base of the caudal, which is superficially emarginated, its lobes rounded, the upper one the longer. Ventrals below or a little before dorsal. Pectorals rounded, as long as head, with a slender smooth spine, the osseous part of which is shorter than the postorbital part of the head. Vomerine teeth in two oval separate patches, bands of fine pointed teeth in jaws, curved backwards, the hindmost the shortest. 8 short widely set gillrakers, much shorter than branchial filaments. Brownish, underside and fins lighter. A blackish spot behind the gillopening and a dark band through base of caudal sometimes visible. Length 190 mm.

Nomen indig.: Dawon bambu (Benkulen).

Habitat: Sumatra (Benkulen, Taluk!, Laut Tador, river Kwantan, Indragiri, Upper Langkat, Djambi!); Banka; Borneo (Serawak).

In fresh water.

2. Callichrous bimaculatus (Bl.).

Silurus bimaculatus Bloch, Ausl. Fische VIII. 1794, p. 24.
Callichrous bimaculatus Bleeker, Atl. Ichth. II. 1862, p. 84. (see syn.).
Callichrous bimaculatus Günther, Cat. Brit. Mus. V. 1864, p. 45.
Callichrous bimaculatus Day, Fishes of India 4°. 1878—1888, p. 476.
Callichrous bimaculatus Vinciguerra, Ann. Mus. Civ. Gen. 2 Ser. IX. 1890, p. 201.
Callichrous bimaculatus Volz, Revue Suisse de Zool. XII. 1904, p. 465.
Ompok bimaculatus Jordan & Seale, Proc. U. S. Nat. Mus. XXXIII. 1938. p. 536.

B. 12—13; D. 4; A. 2. 57—72; P. 1. 12—14; V. 7—8.

Height 4—$4^1/_2$, head $4^1/_2$—$4^3/_4$. Eye $5^1/_2$—$7^1/_2$, its anterior border above the corner of the mouth, 1—$1^2/_3$ in snout, $2^1/_2$ to more than $3^1/_2$ apart. Lower jaw strongly prominent. Praedorsal profile sloping nearly in a straight line, profile of the head concave. Maxillary barbels extending to the middle of the pectorals or to the anal. Mandibulary barbels a little longer or shorter than the eye. Height of dorsal $^2/_3$ of height of body, its distance from the snout about twice in its distance from the

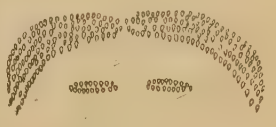

Fig. 83.
Callichrous bimaculatus (Bl.). Teeth of upper jaw and palate. × $2^1/_2$.

caudal. Anal ceases close to the caudal, which is forked, the upper lobe being the longer. Pectorals as long as the head behind the angle of the mouth, their spine of moderate strength, denticulated towards its extremity and about as long as the postorbital part of the head. Ventrals inserted below dorsal. Vomerine teeth in two oval separate patches, bands of fine pointed teeth in jaws, curved backwards, the hindmost the shortest. 9 widely set gillrakers, much shorter than branchial filaments. More or less uniform brownish, with a blackish blotch above the middle of the pectoral fin. A black transverse band at base of caudal. Length 450 mm.

Nomen indig.: Limpok (Mal. Jav.).

Habitat: Java (Batavia!, Buitenzorg, Tjikao, Gempol, Krawang); Sumatra (Benkulen, Indragiri, river Selapian, Deli); Borneo (river Barito, Serawak). — Siam, Burmah to British India and Ceylon.

In fresh water.

7. **Hemisilurus** Bleeker.

(Bleeker. Ichth. Arch. Ind. Prodr. I Siluri. 1858, p. 295).

(*Diastatomycter* Vaillant.)

Compressed, head conical, covered with skin, its upper profile more or less concave, neck elevated. Snout prominent, more or less pointed. Mouth inferior, transverse. Gape wide. Anterior nostrils tubular, much closer together than the posterior ones, which are far distant from them, lying above or behind the frontmargin of the eye. (see fig. 85, 86). A maxillary barbel, lateral of the anterior nostrils and behind them. Mandibulary barbels exceedingly small, very far distant from symphysis. Conspicuous mucous cavities along the mandible. Eyes superior, above the level of the corner of the mouth, covered by gelatinous skin. No dorsal or adipose fin. Anal terminates close to the caudal, which is deeply forked. Ventrals composed of 8—9 rays. Pectorals with a spine. Villiform teeth in the jaws, in two small patches on the vomer. Gillmembranes free from each other and from isthmus. Gillrakers 10—12. Branchiostegals 10—12.

Synopsis of the species.

A. Posterior nostrils above and behind eye.
1. Barbels not reaching to the eye. Head $4^4/_5$, eye $5^1/_2$ . . . . . *H. chaperi* p. 211.
2. Barbels reaching the eye. Head about 6, eye $4^1/_3$—$5^1/_2$ . . . . . *H. heterorhynchus* p. 211.
3. Barbels reaching the opercle. Head 5—$5^1/_3$, eye 7—8 . . . . . *H. moolenburghi* 212.

B. Posterior nostrils above frontmargin of eye, barbels short, stiff, hooked . . . . . *H. scleronema* 214.

1. Hemisilurus chaperi (Vaill.).

Diastatomycter chaperi Vaillant, Bull. Soc. Philom. Paris, (8). III. 1891, p. 182. — Bull. Soc. Zool. XVIII. 1893, p. 61. — Nouv. Arch. Mus. Hist Nat. (3). V. Paris, 1893, p. 70.

A. 93; V. 9.

Height $4^3/_5$, head $4^4/_5$, eye $5^1/_2$, subcutaneous, its centre situated slightly in advance of the middle of the head. Interorbital space about 4 in head. Snout obtuse, slightly more than 3 in head. Maxillary barbels flexible, not reaching the eye, mandibulary barbels far distant from symphysis, minute. Anal long, free from caudal. Ventrals short. Pectorals triangular, their spine $^3/_5$ of the length of the fin. Villiform teeth in more or less curved bands in the jaws and in two small distant patches on the vomer. Length of single specimen known 485 mm. [After Vaillant. Not seen by us].

Habitat: Borneo (Knapei).

In fresh water.

2. Hemisilurus heterorhynchus (Blkr.).

Wallago heterorhynchos Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 514.
Hemisilurus heterorrhynchus Bleeker, Atl. Ichth. II. 1862, p. 94.
Hemisilurus heterorhynchus Günther, Cat. Brit. Mus. V. 1864, p. 54.
Hemisilurus heterorhynchus Vaillant, Notes Leyden Mus. XXIV. 1902, p. 50.

B. 12; A. 90—94; P. 1. 16—17; V. 9.

Height $4^1/_2$—5, head about 6, eye subcutaneous, $4^1/_3$—$5^1/_2$, situated in the anterior half of the head, more than $1^1/_2$ in the convexity of the interorbital space. Snout rounded, slightly prominent, 3 in head. Anterior nostrils short tubes, at the

top of the snout. Posterior nostrils short tubes far behind and above the eye. Maxillary barbels very slender, flexible, reaching the eye. Mandibulary barbels far distant from symphysis, about equal to half of eye, hairlike and scarcely visible. Anal very long, free from caudal. Ventrals reaching the vertical through third anal ray. Pectorals reaching the vertical through fifth or sixth anal ray, a little shorter than head, osseous part of their spine longer than half of head. Fine, curved teeth in curved bands in the jaws, those on the vomer in two very small rounded patches, covered by the strongly developed velum. Gillrakers 10, the longest nearly equalling the branchial filaments. Shiny pearl-colour, dark greyish above. Fins bordered with dark. Length 375 mm.

Nomen indig.: Belut tulang (Djambi).

Habitat: Sumatra (Palembang, Djambi!), Borneo (Sintang, riv. Kapuas, riv. Bunut!).

In rivers.

3. **Hemisilurus moolenburghi** n. sp.

B. 11; A. 90—93; P. 1. 15—16; V. 9.

Height $4^3/_5$—$5^1/_3$, head 5—$5^1/_3$, eyes subcutaneous, 7—8, situated in the anterior half of the head, their distance from the end of the snout goes $1^2/_3$—$1^1/_2$ times in the postorbital part of the head, their diameter about $2^1/_3$ in the snout and 3 to nearly 4 times in the convexity of the interorbital space.

Fig. 84. *Hemisilurus moolenburghi* n. sp. ♂.

Snout rounded or slightly pointed, very prominent before the mouthopening, which is nearly transverse and inferior. Dorsal profile ascending from the snout to the convex back, anteriorly slightly concave. Anterior nostrils tubular, situated at the top of the snout, posterior nostrils bordered by a superior and inferior lip, behind and above eye. Maxillary barbels situated laterally and behind anterior nostrils, originating from a rounded base, in the male rounded, stiff in the proximal part, distally

flexible, gradually setaceous, reaching the anterior border of the opercle; in the female rounded and rather stiff in their proximal half, distally flattened into a rather thick broad membrane, one border of which is split into 3—5 long threads, the longest of which forms the end of the barbel and reaches to the middle of the pectorals. Mandibulary barbels far distant behind symphysis, extremely thin and nearly as long as pupil. Anal ceases before caudal, which is deeply forked, its lobes slightly pointed and shorter than the head. Ventrals reaching to second anal ray, pectorals

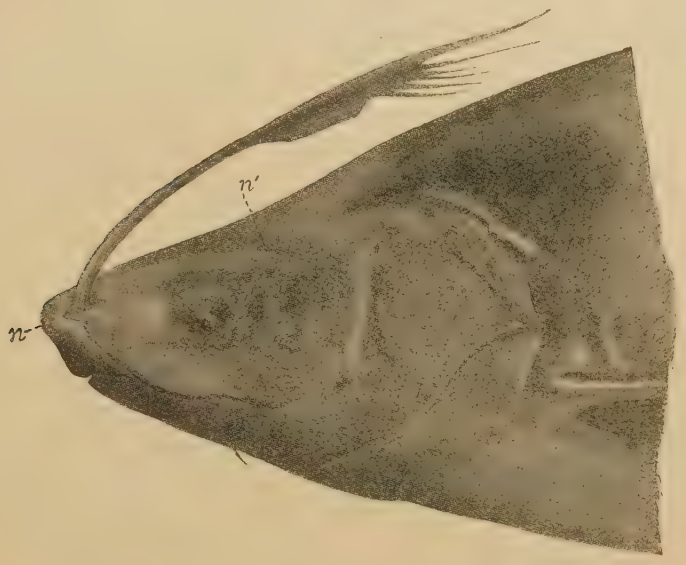

Fig. 85. *Hemisilurus moolenburghi* n. sp. ♀. *n* anterior, *n'* posterior nostril. $^3/_4$ n. s.

which are slightly pointed and about $^1/_4$ shorter than head, a little farther. Villiform teeth in the upper jaw in two broad, gently curved bands, the bands in the lower jaws are more curved and narrowing laterally. Vomerine teeth in two oval patches. 12 gillrakers, a little shorter than branchial filaments. Upper half greyish; lower half bluish pearl-colour, pectorals, ventrals and caudal more or less blackish, anal bordered with black. Length more than 500 mm.

Nomen indig.: Silung buda (Djambi).

Habitat: Sumatra (river Batang Hari!).

4. Hemisilurus scleronema Blkr.

Hemisilurus scleronema Bleeker, Atl. Ichth. II. 1862, p. 93.
Hemisilurus scleronema Vaillant, Notes Leyden Museum, XXIV. 1902, p. 29.

B. 10—11. A. 103—105. P. 1. 15—16. V. 8.

Height $5^1/_2$—6, head 7—$7^1/_4$, eyes subcutaneous, 5—6, situated in the anterior half of the head, their distance from the end of the snout goes twice in the postorbital part of the head, their diameter nearly twice in the convexity of the interorbital space. Snout obtuse, slightly prominent, anterior part of head flattish, almost horizontal, posteriorly slowly ascending to the convexity of the head. Anterior nostrils tubular, situated not far distant from each other at the top of the snout, posterior nostril bordered superiorly and inferiorly by a lip, above the frontborder of the eye. Maxillary barbels stiff, situated laterally of the anterior nostrils, originating from a rounded base broadly compressed, their point hooked. Mandibulary barbels far distant from symphysis, minute, about $^1/_5$ of eye-diameter. Anal ceases before caudal. Ventrals reaching the vertical through the third anal ray, pectorals about the sixth ray; lastnamed are rounded, a little shorter than head, the osseous part of their spine nearly equalling the postorbital part of the head. Fine villiform teeth in a band in the jaws, a few forming two separate patches on vomer. 10 gillrakers, the 4 hindermost rather slender but shorter than branchial filaments. Margaritaceous, back somewhat dark. Caudal fin powdered with blackish, as also the border of the anal. Length 400 mm.

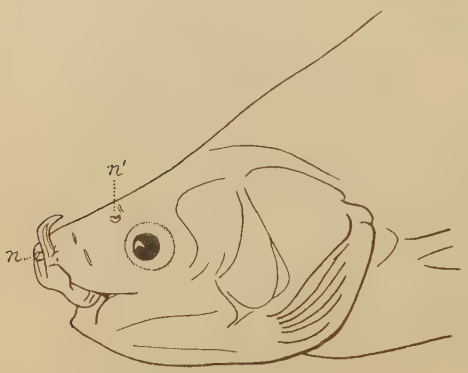

Fig. 86. *Hemisilurus scleronema* Blkr. *n* anterior, *n'* posterior nostril. $^5/_6$ n. s.

Habitat: Java (Krawang); Borneo (rivers Kapuas and Baram); Sumatra (Djambi!).

In rivers.

8. **Cryptopterus** Bleeker.

(Bleeker. Ichth. Arch. Ind. Prodr. I. Siluri 1858, p. 283).

(*Kryptopterichthys* Blkr., *Micronema* Blkr., *Phalacronotus* Blkr., *Hemisilurus* Blkr. p. p.).

Elongate, strongly compressed, snout depressed. Cleft of mouth more or less oblique, not surpassing the eye, which is covered by skin and the lower part of which is situated below the level of the cleft of the mouth. Anterior nostrils tubular, near the frontedge of the snout, posterior nostrils at some distance behind them but before the frontborder of the eye. Laterally from anterior nostril a maxillary barbel; a pair of mandibulary barbels far distant behind the symphysis, generally short, rudimentary or even wanting. Dorsal rudimentary or absent. No adipose fin. Long anal free from or united with caudal, which is deeply forked. Ventrals small or rudimentary with 5—10 rays. Pectorals with a partly osseous spine. Teeth depressible, those of the jaws in a more or less curved band; vomerine teeth in a single band, by exception in 2 separate patches. 8—17 branchiostegal rays. Gillrakers numerous (15—17), rather slender and long. Gillmembranes free from each other and from isthmus.

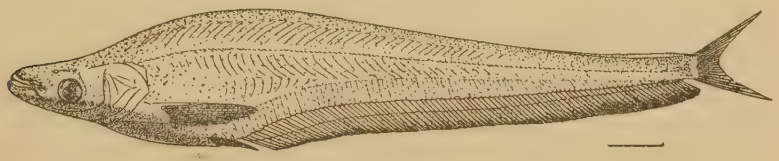

Fig. 87. *Cryptopterus apogon* (Blkr.).

Synopsis of the species.

I. Vomerine teeth in 2 separate patches . . . . . *C. schilbeides* p. 216.

II. Vomerine teeth in one band.

A. Dorsal rudimentary.

1. Mandibulary barbel shorter than head. Anal 52—70.

a. Pectorals equal to head. Anal 52 . . . . . *C. macrocephalus* p. 216.

b. Pectorals much longer than head. A. 53–70.

α. Maxillary barbel extends to ventrals or anal, 8—9 radii branchiostegi. . . . . *C. bicirrhis* p. 217.

β. Maxillary barbel reaching to or surpas-

sing middle of anal, 8—9 radiibranchiostegi. . . . . *C. lais* p. 218.

γ. Maxillary barbel extends to base of pectorals, 10—11 radii branchiostegi. . *C. cryptopterus* p. 218.

2. Mandibulary barbel longer than head. Anal 70 or more.

a. Maxillary barbel extends to posterior quarter of anal, dorsal profile convex, head $6^1/_2$. *C. limpok* 219.

b. Maxillary barbel extends to second fourth of anal, dorsal profile nearly straight . . . *C. mononema* p. 220.

B. Dorsal absent.

a. Vomerine band angular. Pectorals much shorter than head; head $4^3/_5$—$5^1/_3$. . . . . *C. apogon* p. 220.

b. Vomerine band rounded, nearly as broad as palate. Pectorals shorter than head, head $5^2/_3$ . . . . . *C. micronema* p. 221.

c. Vomerine band straight, short, elliptic. Pectorals longer than head, head $6^1/_2$—$7^1/_5$. . *C. hexapterus* p. 222.

1. Cryptopterus schilbeides (Blkr.).

Hemisilurus schilbeides Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 297. Atl. Ichth. II. 1862, p. 94.

Cryptopterus schilbeides Günther, Cat. Brit. Mus. V. 1864, p. 41.

B. 9—10; D. 0; A. 65—71; P. 1. 12; V. 5.

Elongate. Dorsal profile convex, sloping down with a concavity to the snout. Height $4^1/_2$—5, head $6^1/_2$—7, eye $2^1/_2$—3, nearly equal to snout, situated behind corner of mouth, its lower half below the level of the cleft of the mouth, nearly $1^1/_2$ times in the convexity of the interorbital space. Upper jaw slightly prominent. Maxillary barbel reaching about to origin of anal, mandibulary ones rudimentary or missing. Anal free from caudal. Ventrals equal to half eye. Pectorals a little longer than head, the osseous part of their spine equal to snout and eye. Teeth in the upperjaw in a slightly curved narrow band, the band in the lower jaw more curved. The few vomerine teeth in two widely separated small patches. Gillrakers 17. Yellowish, with a few black dots on the top of the snout, along the back and on the anal. Length 120 mm.

Nomen indig.: Lais paddi (Djambi).

Habitat: Sumatra (Palembang, Djambi!); Borneo (Banjermassin, Sarawak (Brit. Mus.)).

In rivers.

2. Cryptopterus macrocephalus (Blkr.).

Kryptopterichthys macrocephalus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 293. — Atl. Ichth. II. 1862, p. 89.
Cryptopterus macrocephalus Günther, Cat. Brit. Mus. V. 1864, p. 41.
Cryptopterus bicirrhis Popta, Notes Leyden Mus. XXVII. 1906, p. 26 (not of C.V.).

B. 9—10; D. 1—2; A. 52; P. 1. 10; V. 6.

Elongate. Dorsal profile convex, slightly sloping down to the snout. Height $4^1/_2$—$4^2/_3$, head 5—$5^1/_3$. Eye 3—$3^1/_2$, nearly equal to snout, situated behind cleft of mouth, only a small part of the eye below the level of the cleft of the mouth, their distance across the convexity of the interorbital space about twice their diameter. Maxillary barbels extending to the end of the first anterior third of the anal. Mandibulary barbels nearly as long as eye. Dorsal just in front of ventrals. Anal free from caudal but connected with it by a membrane. Length of ventrals $2^1/_2$ times in that of pectorals, which are about equal to length of head. The osseous part of pectoral spine about as long as head without snout. Caudal deeply incised. Teeth in the jaws in a narrow crescentic band. Vomerine teeth in a small patch, which is longer than broad. Colour brownish marmorated, dorsal surface darkest. Fins light brownish. Anal with a median longitudinal dark line. Length about 110 mm.

Habitat: Sumatra (Padang?, Djambi!); Borneo (Mahakam). In fresh water.

3. Cryptopterus bicirrhis (C. V.).

Silurus bicirrhis Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 367.
Silurus palembangensis Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 584.
Kryptopterichthys palembangensis Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858. p. 290. — Atl. Ichth. II. 1862, p. 88.
Kryptopterichthys bicirris Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 292. Atl. Ichth. II. 1862, p. 89.
Cryptopterus amboinensis Günther, Cat. Brit. Mus. V. 1864, p. 40.
Cryptopterus palembangensis Günther, Cat. Brit. Mus. V. 1864, p. 40.
Cryptopterus bicirrhis Günther, Cat. Brit. Mus. V. 1864, p. 41.
Cryptopterus bicirris Vinciguerra, Ann. Mus. Civ. Genova XVI. 1880, p. 168.
Kryptopterus palembangensis Fowler, Proc. Acad. Nat. Sc. Phil. (2), LVIII. 1905, p. 468.

B. 8—9; D. 1; A. 53—70; P. 1. 11—12; V. 6—7.

Elongate. Dorsal profile more or less convex, sloping down

with a slight concavity in the nape of the neck to the snout. Height $3^1/_2$—$4^1/_2$, head $5^2/_3$—$6^1/_2$, eye about $2^1/_2$—3, situated behind the cleft of the mouth, nearer to the lower profile of the head, longer than snout, $1^1/_2$ times in the strong convexity of the interorbital space. Maxillary barbels reaching to ventrals or to anal, those of the mandibles — if present — rudimentary and far behind symphysis. Dorsal a little before origin of ventrals. Anal free from caudal. Ventrals nearly as long as the eye. Pectorals much longer than head, the osseous part of their spine somewhat shorter than head. Caudal deeply incised. Teeth in the jaws in a narrow crescentic band, those on the vomer in a more or less oval patch. Gillrakers 15. Colour yellowish, dorsal surface of head and back, pectorals, distal part of anal and hindborder of caudal blackish. A violet spot above the pectorals. Length 170 mm.

Nomen indig.: Limpok (Mal. Batav.), Padgiat, Mahor (Serawak).

Habitat: Java (Batavia, Gempol); Sumatra (Padang, Palembang, Lahat, Djambi!); Borneo (rivers Kapuas, Barito, Mahakam!, Sambas, Baram, Serawak). — Siam.

The locality "Amboina" for *C. amboinensis* Gthr. is certainly erroneous.

In fresh water.

4. Cryptopterus lais (Blkr.).

Silurus lais Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 428.
Kryptopterichthys lais Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 291. — Atl. Ichth. II. 1862, p. 88.
Cryptopterus lais Günther, Cat. Brit. Mus. V. 1864, p. 42.
Cryptopterus lais von Martens, Exp. nach Ost-Asien, Zool. Bd. I. 1876, p. 399.

Differs from the preceding species, according to Bleeker and Günther, by its longer maxillary barbel, reaching to or surpassing the middle of the anal, by the more concave profile of its neck and by the stronger convexity of its back. Perhaps it belongs to *C. bicirrhis*. Length, 125 mm. [Type in the Leyden Museum, in very bad state, examined].

Habitat: Borneo (rivers Sambas, Barito, Kahajan, Danau Sriang).

5. Cryptopterus cryptopterus (Blkr.).

Silurus cryptopterus Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 270.
Kryptopterus micropus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 284. Atl. Ichth. II. 1862, p. 86.

Cryptopterus micropus Günther, Cat. Brit. Mus. V. 1864, p. 42.
Kryptopterus cryptopterus Fowler, Proc. Acad. Nat. Sc. Philadelphia (2) LVII. 1905, p. 468.

B. 10—11; D. 2; A. 64—70; P. 1. 13—15; V. 6—7.

Elongate, compressed, dorsal profile nearly straight. Head depressed. Height $4^3/_4$—$5^1/_2$, head $5^1/_3$—$6^1/_4$. Eye about 3, equal to snout, visible from below, its lower half below the cleft of the mouth, behind which it is situated, twice in the convexity of the interorbital space. Anterior nostrils tubular, near the end of the snout, semitubular posterior nostrils at some distance behind. Upper jaw prominent. Maxillary barbels a little lateral of the anterior nostrils, extending to base of pectorals, mandibulary barbels far behind symphysis, about as long as pupil. Anal free from caudal but connected by membrane with base of the caudal. Ventrals about as long as the eye, pectorals extending to anal, much longer than head. Pectoral spine strong, somewhat shorter, or longer than head. Caudal deeply incised. Maxillary teeth in a narrow semicircular band, broadening posteriorly, in each mandible in an equal broad band, those on the vomer in a curved band. Colour yellowish with a golden hue, powdered with minute black spots, especially on the head and on the pectorals. Length about 200 mm.

Nomen indig.: Lais tungul (Djambi).

Habitat: Sumatra (Palembang, Djambi!, Banjuasin); Borneo (Banjermassin!, Sambas, Sintang, Baram). — Malacca, Siam.

In fresh water.

6. **Cryptopterus limpok** (Blkr.).

Silurus limpok Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 583.
Kryptopterus limpok Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 286. — Atl. Ichth. II. 1862, p. 87.
Cryptopterus limpok Günther, Cat. Brit. Mus. V. 1864, p. 39.
Cryptopterus limpok Steindachner, Abh. Senckenb. Naturf. Ges. XXV. 1901, p. 444.
Kryptopterus limpok Fowler, Proc. Acad. Nat. Sc. Philadelphia (2) LVII. 1905, p. 468.
Cryptopterus limpok Popta, Notes Leyden Mus. XXVII. 1906, p. 24.

B. 11—12; D. 2; A. 77—88; P. 1. 12—14; V. 7.

Elongate, dorsal profile very convex, sloping down with a concavity to the flattened head and snout. Height $4^3/_4$—$5^1/_2$,

head $6^1/_2$ or a little more. Eye about 3, about equal to snout, situated behind the cleft of the mouth and partly below its level, about twice in the convexity of the interorbital space. Anterior nostrils tubular, near the end of the snout; posterior nostrils at some distance behind. Jaws equal. Maxillary barbels extending to the posterior $^1/_4$ of the anal, those of the mandibles at least to the end of the pectorals. Anal free from caudal, ventrals much longer than eye. Pectorals extending far on anal, much longer than head, their spine conspicuously shorter than head. Caudal deeply bifurcated. Maxillary teeth in a narrow curved band, equal to those of the mandibles. Teeth on the vomer in a short straight band. Colour yellowish. Length over 300 mm.

Nomen indig.: Lèè (Kajan), Leys (Koetei), Lais (Djambi).

Habitat: Sumatra (rivers Mussi, Batang Hari!, Kwantan); Borneo (rivers Mahakan, Kahajan, Kapuas, Baram and Sarawak).

In fresh water.

7. Cryptopterus mononema (Blkr.).

Silurus mononema Bleeker, Verh. Bat. Gen. XXI. I, 1847. Nieuwe Bijdr. Silur. Java, p. 8.

Kryptopterus mononema Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 287. Atl. Ichth. II. 1862, p. 87.

Cryptopterus mononema Günther, Cat. Brit. Mus. V. 1864, p. 39.

B. 10—11; D. 2; A. 76—79; P. 1. 14; V. 8.

Elongate, dorsal profile nearly straight. Nape of the neck slightly concave. Height $5^1/_2$, head $7^2/_5$, eye about 4, situated behind the cleft of the mouth, its lower half below the level, about $2^1/_2$ in interorbital space. Jaws equal. Maxillary barbels extend to the second fourth of the anal, those of the mandibles to the base of the ventrals. Anal free from caudal, which is deeply incised. Ventrals three times shorter than pectorals, which are longer than the head. Their osseous spine slightly shorter than the head. Maxillary teeth in a small semilunar band, those of the vomer in a short transverse slightly curved band. Colour above delute olivaceous, below margaritaceous. Fins hyaline, more or less powdered with black. Length over 270 mm. [after Bleeker, not seen by us].

Habitat: Java (Surakarta); Sumatra (Deli).

8. Cryptopterus apogon (Blkr.). [Fig. 87. p. 215].

Silurus apogon Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 67.
Silurus leptonema Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 584.
Silurus micropogon Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 419.
Phalacronotus leptonema Bleeker, Ichth. Arch. Ind. Prodr. Siluri, I. 1858, p. 304. Atl. Ichth. II. 1862, p. 92.
Phalacronotus micropogon Bleeker, Ichth. Arch. Ind. Prodr. Siluri, I. 1858 p. 306, Atl. Ichth. II. 1862, p. 92.
Cryptopterus micropogon Günther, Cat. Brit. Mus. V. 1864, p. 43.
? *Cryptopterus micronema* Vaillant, Notes Leyden Mus. XXIV. 1902, p. 48. (not of Bleeker).

B. 14—17; D. 0; A. 78—91; P. 1. 14—15; V. 9—10.

Elongate. Dorsal profile more or less convex and accordingly sloping down to the snout with a more or less pronounced concavity at the nape. Height $5^2/_3$—7, head $4^3/_5$—$5^1/_3$. Eye 4—6 (9 in a specimen of 770 mm. length), behind corner of the large mouth, its lower half below the level of the cleft of the mouth, $1^1/_2$—$2^1/_2$ in the convexity of the flattened interorbital space ($4^3/_5$ in a specimen of 770 mm. length). Maxillary barbels reaching to the eyes or even to their hind-border, mandibulary barbels very delicate, may be more than half diameter of eye. Anal free from caudal. Ventrals nearly twice the length of the pectorals, which are much shorter than the head, their spine nearly equal to head without snout. Teeth in the jaws rather sharp and curved, in a broad crescentic band, those of the vomer in an angular band. Colour brownish or yellowish, darker on the back, fins may be powdered with black. Length 770 mm.

Nomen indig.: Lais tima (Danau Sriang).

Habitat: Sumatra (Palembang, river Batang Hari, Djambi!); Borneo (Banjermassin!, Kutei!, Pontianak Sintang!, Danau Sriang, Serawak).

In fresh water.

9. Cryptopterus micronema (Blkr.).

Silurus micronemus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 289. Verh. Bat. Gen. XXI. I. 1847, Silur. batav. consp. diagn. p. 56.
Silurus phalacronotus Bleeker, Nat. Tijdschr. Ned. Indië, II. 1851, p. 429.
Phalacronotus micruropterus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 307.
Micronema phalacronotus Bleeker, Enum. spec. pisc. Arch. Ind. 1859, p. 139.

Micronema typus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 300. — Atl. Ichth. II. 1862, p. 91.
Cryptopterus micronema Günther, Cat. Brit. Mus. V. 1864, p. 43.
Micronema phalacronotus Fowler, Proc. Acad. Nat. Sci. Philadelphia, (2) LVII. 1905, p. 469.

B. 14—15; D. 0; A. 86—93; P. 1. 12—14; V. 9.

Elongate, dorsal profile slightly convex, sloping down to the broad flattened head. Lower jaw prominent. Height $5—5^1/_2$, head about $5^2/_3$, eye $3^1/_2—5$, about equal to snout, situated at some distance behind the corner of the mouth, its lower half below the level of the cleft of the mouth, more than twice in the convexity of the interorbital space. Maxillary barbels extending to the hindborder of the eye, those of the lower jaw much shorter than the eye. Anal free from caudal or connected with it. Ventrals longer than eye, pectorals shorter than head, osseous part of pectoral spine equal to snout and eye. Caudal deeply incised. Teeth in the jaws in a rather broad band; the rounded vomerine band occupies nearly the whole width of the palate. Gillrakers 14. Yellowish, a black spot in the middle of the base of the caudal. Finmembranes blackish. Length over 325 mm.

Nomen indig.: Limpok (Mal. Batav.), Lais (Palembang).

Habitat: Java (Batavia); Sumatra (Palembang!); Borneo (rivers Kahajan, Kapuas, Sambas Limbang and Baram). — Siam.

In rivers.

10. **Cryptopterus hexapterus** (Blkr.).

Silurus hexapterus Bleeker, Nat. Tijdschr. Ned. Indie II. 1851, p. 203.
Micronema hexapterus Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 301. — Atl. Ichth. II. 1862, p. 91.
Cryptopterus hexapterus Günther, Cat. Brit. Mus. V. 1864, p. 43.

B. 12—13; D. 0; A. 74—83; P. 1. 16—17; V. 8.

Elongate, sloping down to the snout with a concavity in the neck. Height $5^3/_4—5^1/_3$, head $6^1/_2—7^1/_5$, eye 5—6, situated behind the corner of the mouth and partly below the cleft of the mouth. Lower jaw strongly prominent. The maxillary and mandibulary barbels are sometimes shorter, sometimes rather longer than the head. Anal free from caudal or reaching to it. Ventrals more than twice as small as pectorals, which are rather longer than the head, the osseous part of their

spine, which is not denticulated, scarcely or not longer than postorbital part of head. Teeth in the jaws in a broad curved band, those of the vomer in a very short elliptic band. Length about 240 mm. [Type in Leyden Museum examined].

Nomen indig.: Lais puti (Mal. Banjerm.).

Habitat: Java (Krawang); Borneo (Banjermassin); Sumatra (Palembang). — Siam.

In fresh water.

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3. Fam. Plotosidae.

Elongate, tail tapering. Head depressed. First dorsal fin above or behind origin of pectorals, with a spine, which is smooth, serrated on both edges or only along the hindborder. No adipose fin, but a long or short so called second dorsal or caudodorsal, probably a procurrent part of the caudal, confluent with the caudal and often beginning with a fat pad. Anal many-rayed, confluent with pointed caudal. Ventrals with 10—12 rays. Pectorals with a rather weak or with a strong pungent denticulated spine. Nostrils remote from each other, the anterior ones generally tubular, in the frontborder of the upper lip and looking up or forward, or perforating it and looking downward. Posterior nostril a slit behind the nasal barbel. A pair of maxillary, mandibulary and mental barbels; besides a lateral fold at the corner of the mouth may be produced in a short barbel. Conical teeth in the jaws, which may be wanting in the upper jaw and mixed with molar-like ones in the lower jaw; on the vomer molar-like or conical in a patch or band. Lateral line more or less conspicuous by distant pores. Axillary porus present or absent. A dendritic organ between anus and anal present or absent. Gillmembranes united or more or less separated from each other, totally or partly united with isthmus or free from it. First branchial arch besides gillrakers, without or with a membrane, the free edge of which is fringed or has rounded processes, which may get independent.

Key to the genera.

I. A. praeanal dendritic organ.

1. Anterior nostril perforating upperlip near its anterior border and looking downward. Origin of second

dorsal before or above origin of ventrals. Only anterior portion of gillmembranes confluent with isthmus . . *Paraplotosus* p. 224.

2. Anterior nostril in the frontborder of the upperlip, looking upward or forward.

a. Gillmembranes free from isthmus. Origin of second dorsal behind ventrals. . . . . *Plotosus* p. 226.

b. Gillmembranes united to the isthmus. Origin of second dorsal before or above origin of ventrals.

α. Conical teeth in the jaws, besides molarlike in mandible and on vomer . . . . . *Cnidoglanis* p. 231.

β. No maxillary and no molarlike teeth . . . . . *Oloplotosus* p. 232.

II. No praeanal dendritic organ.

1. Interior border of upperlip perforated by the anterior nostril, which looks downward. Dorsal spine without serrature . . . . . *Porochilus* p. 234.

2. Anterior tubular nostril in the frontborder of the upperlip, looking forward. Dorsal spine serrated behind . . . . . *Copidoglanis* p. 235.

1. **Paraplotosus** (Bleeker) de Beaufort.

(Bleeker, Atl. Ichth. II. 1862, p. 100. (nomen solum)).
(De Beaufort. Bijdr. Dierk. Afl. 19. Amsterdam 1913, p. 97).

Elongate, tail tapering, head depressed, mouth transverse, rounded in front. Lips thick with papillae and vermiculated folds. Upperlip very prominent, perforated at its border near

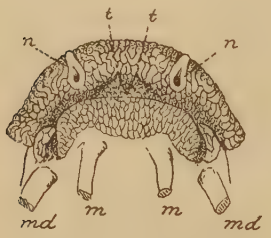

Fig. 88. *Paraplotosus albilabris* (C.V.). View of mouth and lips from below. *n* nostril, *t* teeth, *md* mandibulary, *m* mental barbels.

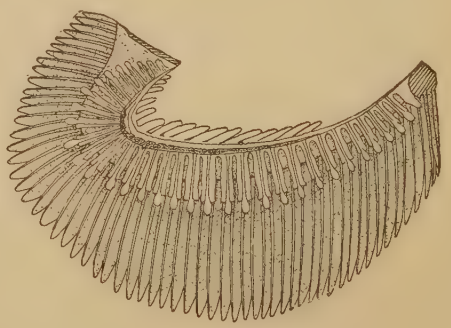

Fig. 89. Inner view of second branchial arch of *Paraplotosus albilabris* (C. V.).

the mouthopening by the anterior nostrils which look downwards and are surmounted anteriorly by a very prominent caniculated lip. Posterior nostril a slit between eye and upperlip

in front of which a nasal barbel. A maxillary barbel near the end of the upperlip, a mandibulary barbel below the corner of the mouth, two mental barbels between the mandibulary barbels. Eye not covered by skin. First dorsal short, behind origin of pectorals, with few rays and a strong spine, denticulated at both edges. Origin of second dorsal before or above origin of ventrals. It is many-rayed, similar to anal and both are confluent with the caudal. Ventrals with 12—13 rays. Pectorals with a denticulated spine. Maxillary teeth in two rhombic patches with the lateral edges rounded, conical with rounded tops. The median ones the strongest. Inframaxillary ones in two approximated semicrescentic patches, the anterior row strong and conical, the posterior ones molars, mesially in 4 rows. Vomerine teeth molar, in a crescentic patch, in the middle in about 4 rows, the hindermost the strongest. 22 gillrakers on the entire first arch. The second and third branchial arches with a series of long cartilaginous processes, covering the base of the gill-laminae on the sides facing each other. Gillmembranes confluent in the middle, only the anterior portion of their confluent part connected with the isthmus. Branchiostegals 9—11. A very conspicuous dendretic organ between anus and anal.

1. Paraplotosus albilabris (C. V.).

Plotosus albilabris Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 427.
Plotosus macrophthalmus Bleeker, Verh. Bat. Gen. XXI. I. 1847, Silur. Batav. consp. p. 179.
Plotosus albilabris Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 319. — Atl. Ichth. II. 1862, p. 99.
Copidoglanis albilabris Günther, Cat. Brit. Mus. V. 1864, p. 27.

B. 9—11; 1. D. 1. 4—5; 2. D. 100—110; A. 90—100; P. 1. 12—13; V. 12—13; C. circa 10.

Height 7—8, head circa 6, anteriorly depressed, posteriorly rather high, sloping with little convexity to the snout. Eye 4—6, more than twice in snout, $1^1/_2$ times in interorbital space, which is concave. Nasal barbels reaching to hindborder of operculum or farther, maxillary ones shorter. Mandibulary barbels much longer than mental ones and almost or quite reaching base of pectorals. Height of first dorsal about $^2/_3$ length of head, its spine as long as postorbital part of

head or a little shorter. Second dorsal and anal rather high. Ventrals reaching the anal, as long as snout and eye, $^1/_4$ shorter than pectorals, about $1\,^1/_2$ in length of head. Pectoral spine nearly

Fig. 90. *Paraplotosus albilabris* (C. V.).

equal to that of first dorsal. Uniform black, undersurface of head and abdomen greyish, lips white. Length more than 350 mm.

Habitat: Java (Batavia); Bintang; Biliton; Singapore!; Celebes (Bulukomba). Aru islands! New Guinea (Sorong!).

In sea.

2. Plotosus Lacépède.

(Lacépède. Hist. Nat. Poissons V. 1803, p. 129).

Elongate, tail tapering, head depressed, covered with thin skin. Mouth transverse, rounded in front. Lips thick with papillae or small laminated folds. Upperlip prominent, anteriorly perforated by the anterior nostril, which forms a short rounded tube. Posterior nostril a slit between eye and lip, in front of which a nasal barbel. A maxillary barbel near the end of the upperlip, a mandibulary barbel near the corner of the mouth and two mental ones between the mandibulary ones. Eye not covered by skin. First dorsal short, behind origin of pectorals, with few rays and a strong spine, denticulated at both edges. Second dorsal beginning between origin of ventrals and anal. It is similar to lastnamed and both are many-rayed and confluent with the caudal. Ventrals with as many as 12 rays. Pectorals with a denticulated spine. Conical teeth in upper jaw in a narrow, square band, those in the mandible mixed with molar teeth, in a semicrescentic band. Vomerine teeth molarlike in a crescentic band. Lateral line well developed. 20—28 gillrakers on the total first branchial arch, similar ones on the second arch, those on the two

following arches are mere knobs. Gillmembranes free from isthmus, mesially nearly totally separated. 9—12 branchiostegals. A conspicuous dendritic organ between anus and anal.

Nomen indig.: Sambilang (Malay.).

Fig. 91. *Plotosus papuensis* M. Web.

Synopsis of the species.

I. Nasal barbel reaching farther than eye, band of mandibulary teeth in 3—5 rows.
  A. Anal and dorsal with more than 100 rays.
    1. D. 130—140. Gillrakers 20. Head 5 or more. Uniform brown . . . . . *P. canius* p. 227.
    2. D. about 112. Gillrakers 26—28. Head less than 5, with 2 longitudinal white bands. . . . *P. papuensis* p. 228.
  B. Anal and dorsal with less than 100 rays. (D. 90; A. 82). Head 4. Uniform dark above, whitish beneath. . . . . *P. abbreviatus* p. 229.

II. Nasal barbel does not reach farther than hindborder of eye. Mandibulary teeth in 2—3 rows. D. 80—100; A. 70—80. . . . . *P. anguillaris* p. 230.

1. Plotosus canius Ham. Buch.

Plotosus canius Hamilton Buchanan, Fishes Ganges 1822, p. 142.
Plotosus canius Cuvier & Valenciennes, Hist. Nat. Poissons XV. 1840, p. 425.
Plotosus unicolor Cuvier & Valenciennes, Hist. Nat. Poissons XV. 1840, p. 426.
Plotosus viviparus Bleeker, Nat. en Geneesk. Arch. Ned. Ind. III (2). 1846, p. 182.
Plotosus horridus Bleeker, Nat. en Geneesk. Arch. Ned. Ind. III (2). 1846, p. 183.
Plotosus multiradiatus Bleeker, Nat. en Geneesk. Arch. Ned. Ind. III (2). 1846, p. 183.
Plotosus canius Bleeker, Atl. Ichth. II. 1862, p. 99.
Plotosus canius Günther, Cat. Brit. Mus. V. 1864, p. 25.
Plotosus canius Day, Fishes of India 4°. 1878—1888, p. 482.

B. 11—13; 1. D. 1. 4—5; 2. D. 130—140; A. 106—118; P. 1. 11—12; V. 12—13; C. circa 10.

Height 8—12, head 5—6$^1/_2$, eye 7—13, eye distance 2$^1/_3$—4 diameters of eye. Snout about thrice as long as eye. Nasal barbels extending to the nape of the neck or at least two eye diameters behind hindmargin of eye. Maxillary barbels reaching a little farther, mandibulary barbels to branchial opening. Mental barbels much shorter. First dorsal as long as snout and eye, its spine about $^2/_5$ of head, serrated on both edges. Second dorsal lower, of uniform height, similar to anal. Caudal rounded. Ventrals shorter than snout. Pectorals as long as or a little longer than first dorsal, their spine similar to that of the first dorsal. Maxillary band of teeth 3 times broader than its antero-posterior length, its conical teeth in about 3 rows; each mandibulary band semicrescentic, mesially with 4—5 rows of teeth, narrowing laterally to one row. Crescentic vomerine band, in the middle with about 4 rows of molar teeth, narrowing to two and finally to one row of teeth. About 20 gillrakers on the total first branchial arch, the 4 most ventral ones very short. Colour in alcohol brown, vertical fin edged with black. Length by exception over 900 mm.

Nomen indig.: Ikan sambilang betul (Mal. Batav.).

Habitat: Java (Batavia!, Samarang, Surabaya, Passaruan); Madura; Singapore; Pinang; Banka; Sumatra (Deli!, Bagan api api! Palembang); Borneo (Banjermassin, Sinkawang, Kota Baru!, Sarawak); Celebes (Macassar! Pare Pare!, Menado); Aru Islands!; British N. Guinea. — Andamans, Burmah, British India and Ceylon.

In sea, brackish water and rivers.

2. Plotosus papuensis M. Web. [Fig. 91. p. 227].

Plotosus papuensis Max Weber, Notes Leyden Museum XXXII. 1910, p. 228.
Plotosus papuensis Max Weber, Nova Guinea IX. 1913, p. 520.

B. 12; 1. D. 1. 4; 2. D. 112; A. 108; P. 1. 13; V. 12; C. 17.

Height 6,6—7,4; head 4,5—4,8; eye 8—12,8; 3—4,6 in snout, which is about as long as or a little longer than the interorbital space. Barbels nearly equal, the nasal one extends nearly to the nape. First dorsal equal to or a little shorter than head without snout. Dorsal spine $^1/_3$ shorter, serrated on both edges. Second dorsal lower than head, of uniform height, similar to anal. Tip of caudal rounded. Ventrals reaching anal, considerably shorter than pectorals. Pectorals rounded, as long

as or a little longer than first dorsal and reaching to ventrals. Pectoral spine shorter than the dorsal one. Teeth in the maxillary band in about 4, in the mandibulary band in about 5 rows, for the greater part molariform, as also those of the vomer, which form a crescentic patch. 26—28 gillrakers on the total first branchial arch, the 4 foremost ones are short. Black, a superior longitudinal white band, beginning opposite first dorsal and narrowing to end of tail, where it gets indistinct. A similar inferior band originating in young ones in the white colour of the abdomen. In large specimens the white abdomen gets dark. Barbels more or less white. Fins black. Length to 550 mm.

Habitat: Lorentz-river, South New Guinea!

3. Plotosus abbreviatus Boul.

Plotosus abbreviatus Boulenger, Ann. Mag. Hist. (6) XV. 1895, p. 247.

1. D. 1. 4; 2 D. 90; A. 82; P. 1. 12; V. 14; C. 18.

Elongate. Height 8, head 4, $1^1/_2$ times as long as broad, its depth $^3/_5$ its width, eye 11, 4 times in interorbital space. Nasal barbel nearly $1^1/_2$ in length of head, extending to praeoperculum. Maxillary barbel to opercle. Pectoral spine a little longer than dorsal, $^2/_5$ of length of head. Maxillary band of conical teeth thrice as broad as long, in 3—4 rows, the anterior of which are by far the largest. Vomerine teeth large, molarlike in a large crescentic patch. Broad band of about 4 rows of molarlike mandibular teeth, with an outer series of large obtusely conical ones. Uniform dark olive above whitish beneath. Length 420 mm. [Type in the British Museum examined].

Habitat: A single specimen from the mouth of the Baram-river, Borneo.

4. Plotosus anguillaris (Bl.).

Platystacus anguillaris Bloch, Ausländ. Fische VIII. 1794, p. 61.
Plotosius ikapor Lesson, Voyage Coquille, Zoologie II. 1830, p. 132.
Plotosus marginatus Bennett, in Life of Raffles, Cat. Zool. spec. 1830, p. 691.
Plotosus lineatus Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 412.
Plotosus anguillaris Cantor, Journ. Asiatic Soc. Bengal, XVIII. 1850, p. 1246.
Plotosus castaneoides Bleeker, Nat. Tijdschr. Ned. Indië, II. 1851, p. 490.
Plotosus arab Bleeker, Atl. Ichth. II. 1862, p. 98.

Plotosus anguillaris Günther, Cat. Brit. Mus. V. 1864, p. 24.
Plotosus Arab Day, Fishes of India 4°, 1878—1888, p. 483.
Plotosus anguillaris Günther, Fische der Südsee, Heft VIII. 1909, p. 372.

B. 12; I. D. I. 4—5; 2. D. 80—100; A. 70—77; P. I. 10—11; V. 11—12; C. circa 10.

Height 6—8, head about 5, eye $5^1/_2$—$7^1/_2$, eyedistance 2—3 diameters of eye. Snout more than twice as long as eye. 8 barbels, more or less equal. Nasal barbels reaching to front or hindmargin of eye. First dorsal about as high as half the length of the head, its spine a little more than half the height of the fin, with the anterior and especially the posterior edge serrated. Second dorsal much lower, of uniform height. Caudal rounded. Anal similar to second dorsal. Ventrals reaching the anal, $^1/_3$ shorter than pectorals, which nearly equal first dorsal. Their spine similar to that of first dorsal. The pectorals do not reach ventrals. Teeth of maxillary band mesially in 2, laterally in one row. Those of the inframaxillary band in 2—3 rows, laterally in one; the lateral teeth a little stronger than those in the middle. Vomerine band crescentic, mesially with 2—3 rows of teeth, of which the posterior median ones are the largest. 25 gillrakers on the entire first branchial arch, the first ones minute. Colour in alcohol brown, lighter on the abdomen. Fins dark. Second dorsal, caudal and anal with a dark edge. When young a narrow white stripe running from snout above eye to near base of caudal. A second one below the eye, above the pectorals, running to posterior portion of tail. Length 300 mm.

Nomen indig.: Sambilang Karang (Malay.), Oselau (Blitok), Ikapor (Waigeu).

Habitat: Java (Batavia!, Bantam, Blitok!); Sumatra (Telokbetong, Priaman, Trussan, Tiku, Siboga, Deli!); Pinang; Singapore; Batu; Nias; Bintang; Banka; Borneo (Balikpapan!, Kota Baru!, Sandakan); Celebes (Macassar!, Kwandang!, Menado!); Buton!; Lombok!; Sangi; Ternate; Batjan; Buru; Ambon!; Ceram; Kei islands!; Aru islands!; Waigeu; New Guinea. — Australia, Lord Howe island, Solomon islands; Fidji islands, Samoa islands to Society- and Kingsmill islands; Philippines; Formosa; Tonkin; China; Japan; Malay peninsula, Siam, Andamans to British India and Ceylon, Red Sea; East Coast of Africa to Madagascar.

In sea, estuaries and rivers.

Doubtful species.

Plotosus macrocephalus C. V.

Plotosus macrocephalus Cuvier & Valenciennes, Hist. Nat. Poissons, XV. 1840, p. 428.

Plotosus macrocephalus Bleeker, Atl. Ichth. II. 1862, p. 98 (after Valenciennes' description and figure).

„This species is obtained from Péron, who caught it at Timor, as we believe. It is easily distinguished by its large head, which is $^1/_4$ of the total length, and only $^1/_4$ less wide than long, and $^1/_2$ as high as long. The eyes are $^1/_9$ of the length of the head, situated in the middle of the head, $2^1/_2$ diameters apart, and directed nearly upward. The lips are very thick, furnished with many fleshy thick papils. — The nasal and external mandibulary barbels are less than half the length of the head; the maxillary and internal mandibulary barbels are still shorter, all thickened at their base.

D. 96; C. 11; A. 95, (tot. 202).

These numbers are however not absolutely certain, as the end of the tail is mutilated. Our specimen is 18 pouces long. In spirits it is brownish grey above and lighter below." (Translated from Valenciennes).

Günther (Cat. Brit. Mus. v. 1864, p. 27, foot note) says that "this fish appears to be allied to *Cnidoglanis megastoma*, but Valenciennes does not make mention of the peculiar gillopening which we observe in the latter species."

Macleay (Proc. Linn. Soc. N. S. Wales VII, 1883, p. 592) records *Plotosus macrocephalus* C. V. from New Guinea, but does not give any description. Only the native name „Deteira" is mentioned.

Nothing else can be said about this species as the type specimen can not be found in the Paris Museum, as Dr. Pellegrin is kind enough to inform us.

3. Cnidoglanis Günther.

(Günther. Cat. Brit. Mus. V. 1864, p. 27).

Elongate, tail tapering, head depressed. Mouth transverse, rounded in front. Lips thick, with papillae. Upperlip prominent. Anterior nostril on the front border of the upperlip,

looking upward. Posterior nostril just behind nasal barbel. A maxillary barbel near the end of the upperlip, a mandibulary one near the corner of the mouth and two mental ones between the mandibulary barbels. Lateral fold at the corner of the mouth may be produced in a short barbel. Eye covered by skin. Origin of first dorsal above or behind origin of pectorals, both with a spine, serrated at both borders. Origin of second dorsal before or above origin of ventrals. It is many-rayed as the anal, both are confluent with the caudal. Ventrals with 10—12 rays. Pectorals with a denticulated spine. Teeth in the upperjaw more or less conical, on the vomer molarlike, in the lower jaw mixed. Lateral line more or less conspicuous. An axillary porus. The second and third branchial arches with a series of long cartilaginous processes, covering the base of the gill laminae, on the sides facing each other. The gill-membranes are united to the broad isthmus along their median line. A conspicuous dendretic organ between anus and anal.

1. Cnidoglanis nudiceps Gthr.

Cnidoglanis nudiceps Günther, Challenger Reports, Zool. VIII. Shore Fishes, 1883, p. 49.

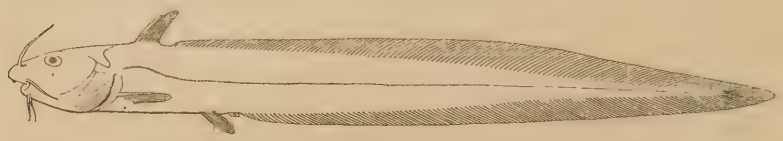

Fig. 92. *Cnidoglanis nudiceps* Gthr. (After the type in the British Museum).

Height about 11, head about 7, depressed, small, its length being equal to its distance from the vent. Its occipital region osseous, not covered with loose skin. Eye $5^1/_2$, shorter than snout, nearly 3 times in postorbital part of head. Lower lip not pendent nor fringed, lateral fold at the corner of the mouth not produced in a barbel. The nasal and maxillary barbels do not extend to the end of the head. First dorsal lower than the body and placed at a very short distance from the occiput, its spine serrated in front and behind, as long and strong as that of the pectoral fin. Maxillary teeth conical, in two small, subtriangular patches; vomerine teeth more obtuse, in two series, which form a subcrescentic band. Mandibulary teeth in a band. Isthmus between the branchial membranes comparatively broad, broader than the interorbital space.

Branchiostegals 7. Light brownish, fins with a black margin. Length of single specimen known 240 mm. [Type in the British Museum examined].

Habitat: Arafura sea.

4. Oloplotosus M. Weber.

(Max Weber. Nova-Guinea IX. Livr. IV. 1913, p. 521).

Elongate, tail tapering, head depressed, covered by thick skin. Mouth transverse, rounded in front, upperlip very prominent, anteriorly perforated by the anterior nostrils, which form short, rounded tubes. Lips thick, with lamellated folds, posterior nostril, in front of which a nasal barbel forms a slit, situated much nearer to lip than to eye. Maxillary barbels near the end of the upperlip, the mandibulary barbels below the corner of the mouth, two mental ones between the intermaxillary ones. Eye covered by skin. First dorsal short, a little behind origin of pectorals, with few rays and a strong spine, denticulated at both edges. Second dorsal beginning before origin of ventrals, it is many-rayed, similar to anal and both are confluent with the caudal. Ventrals with 12—13 rays. Pectorals with a denticulated spine. Conical teeth in about two rows in a narrow crescentic band on mandibels and vomer. No maxillary teeth. Lateral line indistinct. 17 gillrakers on the total first branchial arch. Similar ones on the 2nd arch, none on the following arches. Gillmembranes mesially united with isthmus in their whole length; 10 branchiostegals. A conspicuous dendretic organ between anus and anal.

Fig. 93. *Oloplotosus mariae* M. Web.

1. Oloplotosus mariae M. Web.

Oloplotosus mariae Max Weber, Nova Guinea IX. Livr. IV. 1913, p. 522.

B. 12; 1. D. 1. 4; 2. D. circa 80—90; A. circa 60—70; P. 1. 12; V. 12—13; C. circa 12.

Height $7^1/_3$—$7^1/_2$, head about $5^1/_3$, eye in first half of head

9—11; $3^1/_2$—$4^1/_2$ in snout; eyedistance $1^1/_2$—$1^3/_4$ in snout. Nasal barbels reach the eye or nearly so; about as long as maxillary barbels. Mandibulary barbels the longest, they may reach to branchial opening. Mental barbels shorter. Height of first dorsal more or less than half of head, its spine about $^1/_3$ shorter. Second dorsal and anal similar, lower than first dorsal. Ventrals rounded, about as long as height of first dorsal, about $^1/_3$ shorter than pectorals, which are considerably longer than height of first dorsal, their spine shorter than that of the dorsal. Lower surface of head and abdomen white, uppersurface of head and anterior part of back dark brown, otherwise marmorated dark brown and yellowish, like the fins; but underside of ventrals and pectorals more or less uniform white. Barbels and lips white. Length more than 200 mm.

Habitat: South New Guinea. (Lorentz river!).

5. **Porochilus** M. Weber.

(Max Weber. Nova-Guinea IX, livr. IV. 1913, p. 523).

Elongate, tapering, head more or less depressed, mouth transverse, rounded in front. Eyes covered with skin, lips rather thin, weakly papillated, the thicker underlip lamellated. Upperlip slightly prominent. Its interior border perforated by the anterior nostrils, which look downwards. Posterior nostril a slit behind the nasal barbel, A maxillary barbel at the end of the upperlip, a mandibulary near the corner of the mouth and two mentals between the mandibulary barbels. Origin of first dorsal conspicuously behind origin of pectorals, a little before ventrals, with a rather weak spine, without serrature. Caudodorsal very short, its anterior rays above the last $^1/_5$ of the anal, nearly no procurrent fat pad. Anal many-rayed, confluent with the caudal. Ventrals with 11—12 rays. Pectorals with 7—8 rays and a rather weak spine, which has a few teeth at its frontborder. Conical teeth in 2—3 rows forming two small subtriangular patches in the upper jaw. The mandibulary ones are also conical, crowded in two laterally narrowing and rounded patches, mesially in about 7 rows, the anterior ones a little recurved. Vomerine teeth cylindrical, rather high, with a rounded top, in a patch, rounded anteriorly. The majority of the teeth is light brown or tipped with yellowish. Lateral line more or less conspicuous by distant pores.

No axillary porus. First branchial arch with a membrane along its innerside and with 11 gillrakers on its horizontal branch; second and third branchial arch without processes on the sides facing each other. Gillmembranes united, free from isthmus. Branchiostegals 7.

Fig. 94. *Porochilus obbesi* M. Web.

1. Porochilus obbesi M. Web.

Porochilus Obbesi Max Weber, Nova Guinea IX. livr. IV 1913. p. 523.

B. 7; D. 1. 4; Caudodorsal + C. + A. = 112; A. circa 80; P. 1. 7—8; V. 11—12.

Height about $5^1/_2$, head $6^1/_3$. Dorsal profile sloping down in a straight line from dorsal to snout, posterior profile of back slightly convex. Eye 4, a little shorter than snout, in second $^1/_4$ of head. Nasal barbels about as long as head, mandibulary barbels extend on pectorals, mental ones $^1/_5$ shorter than mandibulary ones, maxillary barbels the shortest of all. Dorsal as long as head without snout; its spine nearly equalling postorbital part of head. Ventrals rounded, as long as dorsal spine, reaching anal, the height of which is $^1/_4$ less than length of head, pectorals $^3/_4$ of head, reaching base of ventrals, in males a little longer. Colour lighter or darker brown, mottled with irregular darker patches. A large dark spot behind the operculum, where the airbladder lies close under the skin which is a more or less protruding. Length about 120 mm.

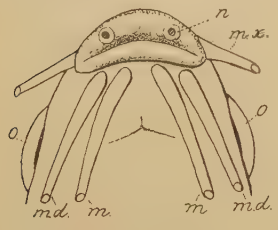

Fig. 95. *Porochilus obbesi.* × 3. Anterior part of head, seen from below; *n* anterior nostril, perforating the upper-lip, *mx* maxillary, *md* mandibulary, *m* mental barbel; *o* eye.

Habitat: South New Guinea (Lorentz river!).

6. Copidoglanis Günther.

(Günther. Cat. Brit. Mus. V. 1864, p. 25).

(*Neosilurus* Steindachner, *Eumeda* Castelnau, *Lambertia* Perugia, *Anyperistius* Ogilby).

Elongate, tail tapering, head more or less depressed, mouth transverse, rounded in front, lips thick, papillated. Upperlip prominent, anterior nostril a short tube in the frontpart of of the upperlip, posterior nostril a narrow slit behind nasal barbel. A maxillary barbel at the end of the upperlip, a mandibulary one near the corner of the mouth and two mentals ones between the mandibulary barbels. Origin of first dorsal conspicuously behind origin of pectorals, with a serrated spine. Caudodorsal generally wanting, but it may extend, in different degrees, forward, never reaching farther than above origin of anal. Anal many-rayed, confluent with caudal. Ventrals with 11—13 rays. Pectorals with 8—12 rays and a denticulated spine. Conical teeth in the upper jaw in two square patches. Front row of mandibulary teeth conical, the other ones molarlike as those on the vomer. Lateral line more or less conspicuous. No axillary porus. First branchial arch with stout gillrakers, few in number and at its innerside with a membrane, the free edge of which is fringed or has rounded processes, which partly may get independent (Fig. 96, 97). Second and third branchial arch with short, weak processes on the sides facing each other. Gillmembranes united, forming a deep notch, free from the isthmus.

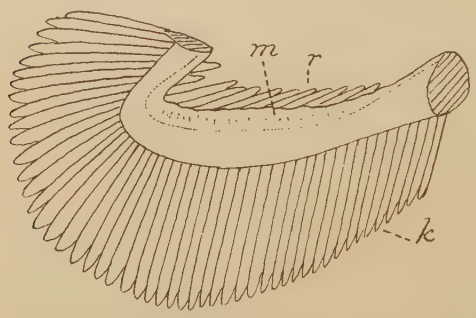

Fig. 96. Part of first gillarch of *Copidoglanis novae-guineæ* M. Web. seen from inner side × 4.5, *m* membrane, *r* gillrakers, *k* gillfilaments.

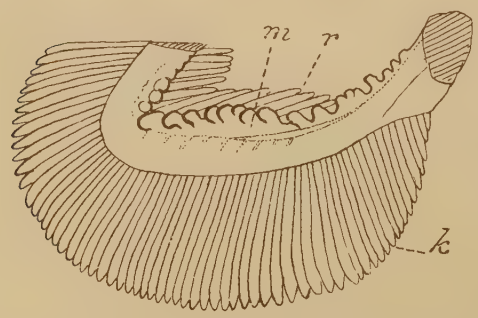

Fig. 97. Part of the first gillarch of *Copidoglanis ater* (Perugia) × 2, seen from inner side. *m* membrane, *r* gillrakers, *k* gillfilaments.

Synopsis of the species.

I. Distal part of dorsal and pectoral spine cartilaginous and flexible, proximal part osseous.
  1. head $4^3/_4$ in length. 19 gillrakers. . . . . *C. gjellerupi* p. 237.
  2. head $5^1/_2$ in length. 23 gillrakers. . . . . *C. equinus* p. 238.

II. Dorsal and pectoral spine totally osseous.
  A. 20 or more gillrakers.
    a. Origin of dorsal slightly behind ventrals . . . *C. meraukensis* p. 239.
    b. Origin of dorsal before ventrals . . . . . *C. ater* p. 240.
  B. 11—13 gillrakers.
    1. Nasal barbel longer than head, eye 6—7. . . *C. brevidorsalis* p. 241.
    2. Nasal barbel shorter than head, eye $4^2/_3$—$5^1/_4$.
      a. Pectoral spine longer than that of dorsal.
        α. Anal 85—90 . . . . . *C. bartoni* p. 242.
        β. Anal circ. 65 . . . . . *C. perugiae* p. 243.
      b. Pectoral spine shorter than that of dorsal *C. novae-guineae* p. 244.

Fig. 98. *Copidoglanis ater* (Perugia).

1. Copidoglanis gjellerupi M. Web.

Copidoglanis gjellerupi Max Weber, Nova-Guinea IX. livr. IV, 1913, p. 528.

B. 10; D. I. 7; Caudodorsal + C. circa 55; A. circa 76; P. I. 11—12; V. 12.

Height about 7, head $4^3/_4$. Dorsal profile slightly convex from first dorsal to eye, from eye to snout slightly concave; eye nearly 8, situated rather high in the frontpart of the posterior half of the head, $3^1/_2$ times in snout, 2 times in the convex interorbital space. Lips thick with partly lamellated papillae; nasal barbels reaching to eye, maxillary barbels reaching beyond eye, mandibulary barbels reaching base of pectorals, mental barbels shorter. Dorsal $1^2/_5$ times in length of head, triangular, its hindborder straight, its origin much

nearer to base of pectorals than to that of ventrals. Dorsal spine a little shorter than longest dorsal rays, only its lower half bony and roughened behind, its superior half cartilaginous and flexible. Height of anterior part of anal a little shorter than half head; caudal slightly longer. The first visible caudodorsal rays emerge about above the middle of the anal from a low fat pad, which begins about above the second $^1/_5$ of the anal. Ventrals rounded, reaching on the anal, a little shorter, than half head. Pectorals reaching the ventrals, equalling $^3/_4$ of the head. Pectoral spine a little shorter than longest rays, its distal half cartilaginous and flexible, its lower half bony and roughened behind. Anterior half of body with closely set, hairlike filaments. On the upper surface of the head they are smaller and much more distant. Maxillary teeth in two juxtaposed oval patches, about two times broader than long, molarlike, the front series more or less cylindrical and conical. Mandibulary teeth molar, in two rounded patches, tapering laterally. Vomerine teeth molar, in a triangular patch, the rounded top of which is directed forward, its base being concave. Horizontal branch of first branchial arch with 19 gillrakers, besides 2 very low anterior ones; the freeborder of its membrane irregular, anteriorly with independent tubercles. Dark brownish, with darker markings, belly, underside of head, lips, underside of paired fins and inferior barbels whitish. Length of single specimen known 263 mm.

Habitat: German New Guinea. (Kaiserin Augusta-river!).

2. Copidoglanis equinus M. Web.

Copidoglanis equinus Max Weber, Nova Guinea IX. livr. IV, 1913, p. 527.

B. 10; D. 1. 7; Caudodorsal + C. + A. about 160; A. about 75; P. 1. 12; V. 13.

Height about 7, head $5^1/_2$. Dorsal profile slightly convex from dorsal to before eye, snout slightly concave, eye situated just behind the middle of the head, very high, near the level of the surface of the head, looking upwards, 7—$8^1/_2$ times in head, about 3 times in the convex interorbital space. Lips thick, papillated and lamellated, their lateral lobe very prominent. Nasal barbels reaching the middle of the eye, mandibulary and maxillary barbels equal, a little longer than nasal

ones; mental barbels much shorter. First dorsal triangular, its hindborder straight, its soft rays gradually decreasing in size, $1^2/_5$—$1^1/_2$ times in length of head, its origin much nearer to base of pectorals than to base of ventrals. Its spine cartilaginous and flexible in its upper portion, a little shorter than longest rays, hindborder of its osseous part finely denticulated. Anal with rays of equal length, their height a little less than half length of head, forming with the caudal and caudodorsal a round outline, the lastnamed with anteriorly gradually decreasing rays, which finally disappear in a very short fat pad, reaching to about above the end of the first $^1/_6$ of the anal. Ventrals rounded, reaching to anal, half as long as head. Pectorals triangular, their longest anterior ray reaching to base of ventrals or a little farther, $^1/_5$ shorter than head. Pectoral spine as long as first soft ray, its greater distal part is cartilaginous and flexible, hindborder of its osseous part denticulated. Upper surface of head and anterior part of body with closely set, hairlike filaments extending farther backwards in older specimens, more distant on head, especially in young. Lateral line very conspicuous. Maxillary teeth very few in number, in two small, oval patches, conical or cylindrical with rounded tops. Similar teeth, also very few in number, form a small, round patch on each mandible. The few rounded vomerine teeth arranged in a semilunar patch. Horizontal branch of the first branchial arch with 23 gillrakers, its membrane low, the free border of which is crenulated, especially anteriorly. Light brown with darker markings, in older specimens greyish by the velvety covering of hairlike papillae. Paired fins, caudal, belly, underside of head, top of snout and barbels whitish. Length 415 mm.

Habitat: Dutch South New Guinea. (Lorentz river!).

Note: In a full grown ripe female (415 mm. long), the pectorals are shorter ($^2/_5$ shorter than head), the ventrals also (conspicuously less than half head), and the nasal barbel nearly 1 eye diameter distant from eye.

3. Copidoglanis meraukensis M. Web.

Copidoglanis meraukensis Max Weber, Nova-Guinea IX. livr. IV, 1913, p. 529.

B. 8; D. 1. 4; A. circa 80; P. 1. 10; V. 11—12.

Height a little more than length of head, about $5^2/_5$. Dorsal profile sloping down from first dorsal, a little convex behind head,

slightly concave from nape to snout. Back more or less convex. Eye in the second $^1/_4$ of the head, $5^1/_2$—6 in head, about $1^1/_2$ times in snout, 3 times or less in the slightly convex interorbital space. Lips with lamellated papillae. Nasal and maxillary barbels equal in length, $^2/_3$ of head; mandibulary barbels reaching on pectorals, mental barbels slightly shorter. Height of dorsal equal to head without snout. Origin of dorsal slightly *behind* ventrals. Dorsal spine entire in front, its hindborder with a few weak teeth, shorter than postorbital part of the head. Anal as high as dorsal spine. Caudodorsal rays few in number, disappearing rapidly in a short low fat pad. Ventrals rounded, reaching on the anal, $2^1/_2$ times in head. Pectorals as long as head without snout, reaching far behind origin of ventrals, their spine with distinct teeth on its inner border. Maxillary teeth in two patches, twice as long as broad, those in the front row conical, the rest cylindrical with rounded tips. The inframaxillary teeth in two oval patches, the innersides of which are concave, the anterior teeth more or less conical, the other ones with rounded tips. Vomerine teeth molar, in a large rounded patch, which is anteriorly more curved than posteriorly. Some of the teeth are yellow- or brown- tipped. First branchial arch with 20 gillrakers on the lower branch, the membrane of which has thick papillae along its free border, inwards of which a row of short tubercles. The belly and underside of head white, otherwise brown, back blackish, mottled with dark. Median fins dark. Underside of paired fins lighter. Barbels blackish. Length 240 mm.

Habitat: South New Guinea (Merauke!). In ponds.

4. **Copidoglanis ater** (Perugia). [Fig. 97. p. 236 and 98. p. 237].

Lambertia atra Perugia, Ann. Mus. Civ. Genova (2) XIV. 1894, p. 551.
Neosilurus mediobarbis Douglas Ogilby, Ann. Queensl. Mus. N°. 9. 1908, p. 12.
Neosilurus mediobarbis Max Weber, Abh. Senckenb. Naturf. Gesellsch. XXXIV. 1911, p. 21.
Copidoglanis ater Max Weber, Nova Guinea IX. livr. IV, 1913, p. 530.

B. 10; 1. D. 1. 4—5; Caudodorsal + C. + A. circa 120; A. 82—88; P. 1. 10—12; V. 12—14.

Height 5—7, head 5—$5^1/_4$. Dorsal profile sloping down from first dorsal, with a little convexity to the eye. Profile of the snout slightly concave. Profile behind first dorsal more or less

straight. Eye 5—6, $2^1/_2$ to nearly 3 in snout. Interorbital region rather convex, 2 times diameter of eye. Lips with lamellated papillae. Nasal barbels reaching about to the middle of eye, maxillary barbels a little farther, mandibulary barbels by far the longest, reaching to the vertical through base of pectorals or nearly so. Mental barbels extending nearly to the gill-opening. First dorsal about $1^1/_3$ in the length of the head. Origin of first dorsal nearer to origin of ventrals than to pectorals. Dorsal spine slender, about as long as head without its postorbital part. Highest part of anal equalling the length of head without snout. The caudal is longer and united with the caudodorsal, the rays of which soon disappear above the hindmost $^1/_4$ of the anal in a pad of fat extending for a short distance on the median line of the back. Ventrals rounded, extending on the anal, a little longer than postorbital part of the head. Pectorals equalling first dorsal, their spine as long as or a little longer than that of dorsal, strongly serrated behind. Each group of intermaxillary teeth in a quadrangular patch, nearly two times as broad as long, the mandibulary patches more or less rhombic, about $1^1/_2$ times as wide as long. Vomerine teeth in a broad patch, rounded anteriorly and rectilinear behind. All teeth brown. First branchial arch with 20—21 gillrakers (28—29 on the whole arch), shorter than filaments, about $^1/_2$ length of eye; its innerside with a short membrane with rounded papillae on its free edge, which are partly independent. Uniform dark brown, underside of head, innerside of upperlip, underlip and its barbels, paired fins and belly whitish. Length about 350 mm.

Habitat: Aru-islands!; South New Guinea (Inawi, on the St. Joseph- or Paumomu-river!, Lorentz-river!). — Queensland?

5. Copidoglanis brevidorsalis Gthr.

Copidoglanis brevidorsalis Günther, Ann. Mag. Nat. Hist. 1867, p. 22.
Neosilurus brevidorsalis Steindachner, Sitzber. K. Akad. Wien, LVI. 1867, p. 319.
Neosilurus brevidorsalis Max Weber, Abh. Senckenb. Naturf. Ges. XXXIV. 1911, p. 21.

B. 9; I. D. I. 4; Caudodorsal + C. + A. circa 130; A. circa 83; P. I. 10; V. 12.

Height $5^1/_2$—$6^1/_2$, about equal to head. Dorsal profile sloping down in a right line from dorsal to snout, profile behind

dorsal slightly convex. Eye 6—7, $2^1/_2$ in snout, $2^1/_2$ to nearly 3 times in the slightly convex interorbital space. Lips rather thin, papillated, prominent at corner of mouth. Nasal barbels extending to the base of first dorsal when young, in adults not so far. Maxillary barbels reach middle of pectorals, the mandibulary and mental barbels not so far [1]). First dorsal about as long as head without snout, its spine equalling about the postorbital part of head, with a serrature at the frontborder. Origin of dorsal midway between origin of ventrals and pectorals. Pad of fat of the caudodorsal begins a little behind the middle of the anal fin, from it emerge a little farther behind distinct rays, increasing gradually in size. Anal a little higher than half length of head. Ventrals rounded, as long as postorbital part of head, extending on anal. Pectorals $^1/_5$ shorter than head, extending to the ventrals or not so far, their spine nearly as long as that of the dorsal, serrated behind. Maxillary teeth in a nearly continuous band of 4—5 rows. Mandibulary teeth in two triangular patches. Vomerine ones in a semilunar patch of about 4 rows in the middle. Teeth white, more or less light brown tipped. First branchial arch with a well developed entire membrane. Gillrakers 11—13, as long as branchial filaments, more than $^2/_3$ of eye. Colour uniform brown or black. Length 200 mm.

Habitat: South New Guinea (Lorentz-river!); Aru-islands!.— Australia (Cape York).

Fresh water.

6. **Copidoglanis bartoni** (Regan).

Neosilurus bartoni Tate Regan, Ann. Mag. Nat. Hist. ser. 8, vol. 1, 1908, p. 153.

Depth of body $6^1/_2$ in the length, length of head $5^2/_3$. Head much broader than deep, its breadth $1^1/_3$ in its length, diameter of eye $4^2/_3$, length of snout $2^3/_4$—3, interorbital width $2^4/_5$—$3^1/_5$. Lower jaw shorter than the upper. The barbels are as long as or a little shorter than the head; when laid back the nasals just reach the edge of the occiput, the maxillaries a little beyond the edge of the operculum, the outer mandi-

1) In Steindachners specimens and in some of those which we have seen from the Lorentz-river (from Sabang), the maxillary and mandibulary barbels reach beyond the extremity of the pectorals.

bularies the anterior $^1/_4$, and the inner mandibularies the base of the pectoral fin [1]). 12 or 13 gillrakers on the lower part of anterior arch. Dorsal I 5, the spine nearly $^3/_5$ the length of head, with a few weak denticulations anteriorly, nearly smooth or very finely denticulated posteriorly; procurrent part of caudal commencing above the middle of anal, anteriorly very low and without distinct rays. Anal 85—90. A + C + D = circa 135 [1]). Pectoral not extending to the base of ventrals, its spine similar to but a little longer than that of the dorsal; ventrals extending a little beyond the origin of anal. Uniformly greyish. Total length 122 mm. [After Regan. Not seen by us].

Habitat: Sogeri, British New Guinea.

7. Copidoglanis perugiae (Ogilby).

Eumeda elongata? Perugia, Ann. Mus. Civ. Genova, (2) XIV. 1894, p. 552. (nec Castelnau).
Anyperistius perugiae Ogilby, Ann. Queensland Mus. N°. 9. 1908, p. 11.
Copidoglanis perugiae Max Weber, Nova Guinea IX. livr. IV, 1913, p. 531.

D. 1. 5; A. circa 65; A. + C. + Caudodorsal circa 90—100; P. 1. 8; V. 11—12.

Height 8, head nearly $5^3/_4$. Dorsal profile slightly convex between dorsal and interorbital space, from there to blunt snout straight. Eye $5^1/_4$, in second $^1/_3$ of the head, $1^3/_4$ in snout, which is equal to interorbital space. Jaws equal or the upper jaw slightly prominent. Nasal barbels reaching beyond operculum or not so far. Maxillary barbels slightly farther, mandibulary barbels to end of pectoral spine, mental barbels to first $^1/_4$ of pectoral. Height of dorsal equal to head without snout, its spine weakly serrated on both borders, somewhat longer than postorbital part of head, its origin far in advance of ventrals. Anal about as high as dorsal spine, caudodorsal rays conspicuous to opposite the 4. fifth of the anal, anteriorly disappearing in a short procurrent fat pad. Ventrals acutely rounded, reaching on anal, more than twice in head. Pectorals somewhat longer than head without snout, not reaching the ventrals. Their spine, somewhat longer than dorsal spine, with weak teeth on the hindborder and on the top of the frontborder. A band of conical teeth in the jaws,

1) After information kindly given to us by C. Tate Regan.

the front series in the upper jaw slightly directed anteriorly, the posterior rows slightly directed backward, give the impression of being recurved; on the palate a similar band of granular teeth. Some of the teeth are yellow or brown tipped. 12 gillrakers on the lower branch of the first branchial arch, which has a rather high membrane at its innerside, decreasing anteriorly. Uniform brown. Head and anterior part of body darker. Length 120 mm.

Habitat: British New Guinea (Inawi on the St. Joseph- or Paumomu-river!).

8. **Copidoglanis novae-guineae** M. Web. [Fig. 96, p. 236].

Copidoglanis novae-guineae Max Weber, Nova Guinea, V. livr. II, 1908, p. 226.

1. D. 1. 4; A. about 80; P. 1. 10; V. 12.

Height nearly equal to length of head, about 6. Profile from first dorsal sloping downwards in a straight line. Head nearly as high as broad. Skin of head finely granulated. Eye $5^1/_4$ in head, $2^1/_4$—$2^1/_3$ in convex interorbital space, about 2 in snout. Lips thick, irregularly papillated, the prominent upperlip partly laminated. Nasal barbels extend at least one eye diameter farther than the eye and may nearly reach to the hindborder of the operculum. Mandibular barbels reaching the middle of the base of the pectorals or a little farther. Mental barbels $^1/_4$ shorter, maxillary barbels still shorter. Origin of first dorsal a little before origin of ventrals; its spine weakly serrated in front and behind, about as high as length of snout and eye, its soft rays as long as head without snout. Highest part of anal a little longer than snout; caudodorsal above the last third of the anal, represented by a low pad of fat from which the rays emerge and increase gradually in size. Ventrals rounded, extending to the anal, as long as postorbital part of the head. Pectorals as long as head without snout, nearly extending to the base of the ventrals, their spine shorter than that of the dorsal, weakly serrated along the hindborder. Maxillary teeth in a nearly continuous band of three rows; those of the mandibulary in two triangular patches of about 5 rows, the vomerine ones in a semilunar patch of about 5 rows. All teeth white. First branchial arch with a well developed membrane. 12 gillrakers on the horizontal branch of the first branchial arch, shorter than branchial filaments,

$^2/_3$ length of eye. Lighter or darker brown, underside of head and belly whitish, some specimens with irregular dark markings. Length over 180 mm.

Nomen indig.: Sinonga.

Habitat: North New Guinea (Lake Sentani!).

4. Fam. CHACIDAE.

Head very large, strongly depressed, nearly aequilateral. Body depressed anteriorly, compressed posteriorly and rapidly tapering. Lower jaw prominent. Mouth very wide. The tubular anterior nostrils on its anterior border; posterior nostrils at some distance behind, with a short tentacle. Eyes very small, covered by skin. A barbel at the corner of the mouth, originating from a broad fold of the skin, two mental ones behind the border of the mandible, distant from each other; at some distance behind them a pair of mandibulary barbels. Moreover the skin is provided with arborescent prominent papillae. Lateral line represented by a papillated and tuberculated ridge reaching the tail. The short dorsal fin with a strong spine and three or four rays. Anal with 7—10 rays. Rounded caudal with a long procurrent dorsal part and a shorter ventral part. Ventrals very broad, behind the dorsal, six-rayed. Pectorals with four or five rays, with a short, very strong spine, the broad anterior inferior border of which is concave. Gillmembranes confluent with the skin of the broad isthmus, the gill-opening being thereby reduced in extent. Small villiform teeth in jaws. Palate edentulous. No axillary pore.

1. **Chaca** Valenciennes.

(VALENCIENNES in: Bélanger, Voyage Indes orientales, Zool. Poissons, 1834, p. 385).

For characters of the single genus see those of the family.

Fig. 99. *Chaca chaca* (Ham. Buch.).

1. Chaca chaca (Ham. Buch.).

Platystacus chaca Hamilton Buchanan, Fishes of the Ganges, 1822, p.p. 140, 173.
Chaca lophioides Valenciennes, in Bélanger, Voy. Ind. Orient. Zool. Poiss. 1834, p. 386.
Chaca lophioides Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 545.
Chaca bankanensis Bleeker, Natuurk. Tijdschr. Ned. Ind. III. 1852, p. 455. — Atl. Ichth. II. 1862, p. 96.
Chaca lophioides Kner, Sitzber. Akad. Wien, XVII. 1855, p. 101.
Chaca lophioides, *bankanensis*, *buchanani* Günther, Cat. Brit. Mus. V. 1864, p. 29.
Chaca bankanensis v. Martens, Exp. Ost-Asien, Zool. I. 1876, p.p. 302, 399.
Chaca bankanensis Volz, Zool. Jahrb. Syst. XIX. 1903, p. 383. — Revue Suisse Zool. XII. 1904, p. 463.

B. 6; D. 1. 3—4; A. 7—10; P. 1. 4—5; V. 6; C. 20—25 + 10—11 + 8—12.

Height about 6. Head a little longer than broad, 3 times in length. Eye in the anterior $^1/_4$ of the head, very small, 15—20 in head. The width of the interorbital space equals half of the head. Dorsal spine 5—6 times in length of head, its frontborder at the top with a few indentations, much shorter than soft rays. Rounded ventrals $2^1/_3$ in head. Pectorals about $^1/_3$ shorter, their spine 3 times in head, strongly dentated along its anterior border. The cutaneous appendages on top and sides of head and on sides of body are, according to individuals and perhaps to sex, tubercular, shorter or longer, simple or arborescent. Lighter or darker brownish, marbled with lighter, especially on the fins, which may have a whitish border. Length 200 mm.

Nomen indig.: Puting bliong (Djambi), Tuka (Danau Sriang, Borneo).

Habitat: Sumatra (Djambi!, Laut Tador, Sungei Mati, Indragiri, Djapura, Taluk!); Borneo (rivers Barito and Kapuas, Danau Sriang, Sarawak); Banka. — Malacca, Burmah and British India. — Kner mentions the fish from New Guinea. This is without question erroneous.

In rivers and lakes. Its flesh is considered to be poisonous by the natives in some parts of Sumatra.

5. Fam. Pangasidae.

Elongate, compressed, head generally covered by soft skin. Mouth small, anterior or subanterior, in the last case snout prominent. Eye with a free orbital margin, behind corner of

mouth and generally partly below its level. Anterior nostrils pierced through the extremity of the snout, posterior ones different. Four to eight barbels. Short dorsal with 5—7 rays and a pungent spine, preceded by a broad but very low rudimentary spine. Adipose fin small, above the posterior part of anal. Anal elongate with 28—40 rays, distant from caudal, which is bifurcate. Ventrals well developed with 6—7 rays, situated behind dorsal. Pectorals with a pungent spine. Teeth small, in the jaws generally in curved bands; when present on the palatines, they may be free from or confluent with those of the vomer, which are in one or two patches. 7—11 branchiostegals. Gillmembranes free from isthmus, more or less united or free from each other.

In the Indian Archipelago, freshwater fishes of its western part.

Key to the genera.

I. 8 barbels, one pair of nasal barbels. Mouth terminal . *Pseudeutropius* p. 247.

II. 6—4 barbels; no nasal barbels. Mouth subterminal.

1. 4 mandibulary barbels . . . . . *Lais* p. 250.

2. 2 mandibulary barbels.

a. Posterior nostril between anterior one and eye; eye behind and totally above corner of mouth. No palatine teeth. . . . . *Helicophagus* p. 251.

b. Posterior nostril at short distance from anterior and above a line between anterior nostril and eye. Eye partly below a horizontal through the corner of mouth. . . . . *Pangasius* p. 254.

1. **Pseudeutropius** Bleeker.

(Bleeker, Verh. Akad. Amsterdam XIV. 1862, p. 398).

Elongate, compressed, head conical, covered by thin skin. Anterior nostrils wide openings at the top of the head looking upwards, the small posterior nostrils, which are nearer to each other, behind the more distant anterior nostrils. A nasal barbel between nostrils, a maxillary near the corner of the mouth, 2 mandibulary and 2 mental ones along the frontmargin of the lower jaw. Mouth anterior, eye behind and partly below its corner, with a free orbital margin. Short dorsal with a pungent, denticulated spine and 5 to 6 rays. A small adipose fin. Anal fin elongate, terminating at some distance

from the caudal, which is forked. Ventrals with six rays. Pectorals with a serrated spine. Small teeth in narrow bands on the jaws, those on the palate in two patches which may be connected. 9—10 branchiostegal rays. Gillmembranes free from isthmus and slightly connected anteriorly. Gillrakers slender, numerous.

Synopsis of the species.

I. Anal with 28 rays, more than 3 times in length of body . . . . . *P. brachypopterus* p. 248.
II. Anal with 40 rays, more than 2 times in length of body . . . . . *P. moolenburghae* p. 249.

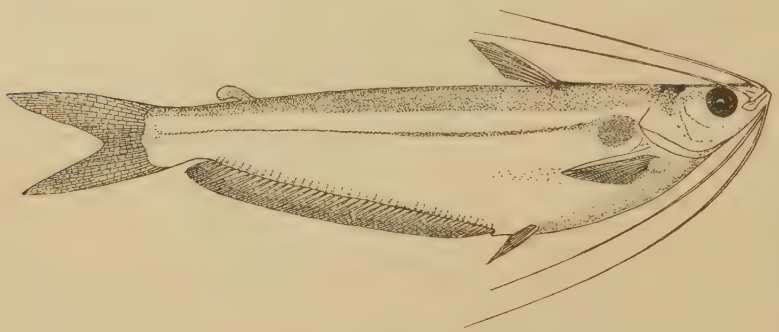

Fig. 100. *Pseudeutropius moolenburghae* n. sp.

1. Pseudeutropius brachypopterus (Blkr.).

Eutropius brachypopterus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 169.
Pseudeutropius brachypopterus Bleeker, Atl. Ichth. II. 1862, p. 71.
Pseudeutropius brachypopterus Günther, Cat. Brit. Mus. V. 1864, p. 58.

B. 9—10; D. 1. 6; A. 28; P. 1. 8; V. 6.

Moderately elongate, compressed, head conical, profile sloping down from dorsal to snout, nearly straight. Height $4^2/_5$, head 4. A median groove running from the end of the snout to the base of the occipital process, with a constriction at the vertex. Occipital process very long and slender, bifurcated at its end, to receive the interspinal bone of the dorsal spine. Jaws equal. Eye 3—4, about equal to snout, a little less than interorbital space. Nasal barbels reaching on dorsal or not so far, maxillary and outer mandibulary ones beyond end of pectorals, mental ones somewhat shorter. Dorsal as long as

head without snout, its spine somewhat shorter, denticulated at its hindborder and at the top of its frontborder. Height of adipose fin a little less than diameter of eye, opposite to end of anal, the length of which goes more than thrice in length of body. Ventrals extending to anal, about equal to postorbital part of head. Pectorals a little shorter than dorsal, their spine still shorter, very strong and strongly denticulated at its inner border. Minute teeth in narrow bands on the jaws; on the vomer in two small patches connected by an angular line of teeth. Yellowish, a blackish band in the lateral line, a less distinct but broader band below and above it, the latter more or less confluent with a dark median band on the back. A distinct black blotch at the origin of dorsal. Upper surface of head, mandibles, caudal, margin of anal and part of the remaining fins darkish. Length 115 mm.

Habitat: Sumatra (Palembang, Djambi!); Borneo (Danau Sriang).

In rivers and lakes.

2. **Pseudeutropius moolenburghae** n. sp. [Fig. 100, p. 248].

B. 9; D. 1. 5; A. 40; P. 1. 9; V. 6.

Moderately elongate, compressed, head conical, profile sloping down from dorsal to snout, nearly straight. Height $4^1/_5$—$4^4/_5$, head about $4^3/_5$. A median groove running from the snout to the end of the occipital process, but separated in two on the vertex by a transverse constriction. Occipital process separated from the first interspinal bone. Jaws equal. Eye 3—4, situated behind the corner of the mouth and partly below it, about equal to the flattish interorbital space. The nasal barbels reach as far as the depressed dorsal. Maxillary barbels near the corner of the mouth, extending to the anterior part of the anal, as is also the case with the mandibulary and mental barbels which originate in approximated pairs immediately behind the border of the upperlip. Dorsal a little longer than head without snout, its weekly denticulated spine distinctly shorter. Height of adipose fin equal to the diameter of the eye, situated before the end of the anal, the length of which goes more than twice in the length of the body. Ventrals about equal to postorbital part of head, reaching anal; their origin just behind dorsal. Pectorals about equal to head without snout,

their spine nearly as long as the dorsal one, its innerborder strongly denticulated. Teeth minute, in the jaws in a narrow band, on the vomer in two widely separate elliptic patches. About 26 slender gillrakers, as long as branchial filaments. Yellowish, a blackish band in the lateral line, a less distinct but broader band below and above it, the latter more or less confluent with a dark median band on the back. A distinct black blotch at the origin of the dorsal. Upper surface of head, mandibles, caudal, margin of anal and part of the remaining fins darkish. In larger specimens the colours are fainter. Length about 100 mm. — Named in honour of Mrs. Moolenburgh.

Nomen indig.: Beringgit (Djambi).

Habitat: Sumatra (Batang Hari river!).

2. **Lais** Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 170).

Elongate, compressed, head conical, covered by thin skin, through which the bones of the head are partly visible. Anterior oval nostrils piercing through the anterior part of the snout, posterior nostrils, wide transverse slits, close together on the upper surface of the snout. Upper jaw prominent, mouth narrow, subterminal. Eyes with a broad circular adipose eyelid, situated behind and partly below mouth. Six ribbon-shaped barbels. Two maxillary barbels at the corner of the mouth and four shorter mandibulary and mental ones, close together immediatly behind the symphysis. Short dorsal with a pungent, denticulated spine and 7 soft rays. Adipose fin minute. Anal elongate, far distant from caudal. Ventrals with 6 rays, far behind dorsal. Pectorals with a pungent, denticulated spine. Caudal deeply incised. Small teeth in the jaws in a rather narrow curved band, those of the vomer in two separate straight bands. Gillmembranes free from isthmus and from each other. 8—9 radii branchiostegi.

1. **Lais hexanema** (Blkr.).

Pangasius hexanema Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 588.

Lais hexanema Bleeker, Ichth. Arch. Ind. Prodr. I. 1858, p. 171. — Atl. Ichth. II. 1862, p. 72.

Lais hexanema Günther, Cat. Brit. Mus. V. 1864, p. 57.

B. 8—9; D. I. 7; A. 3. 36—39; P. I. 9—10; V. 6.

Height $4^1/_2$—$4^3/_4$, head 5, eye less than 3, shorter than snout, the distance of the eyes is dorsally more, ventrally less than diameter of eye. Occipital process very narrow. Maxillary barbels extending to the ventrals or on the anal, those of the mandibles to the base of the pectorals. Dorsal equal to head without snout, its spine, the hindborder of

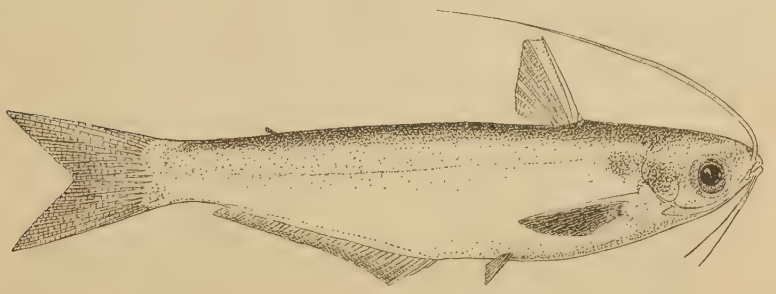

Fig. 101. *Lais hexanema* (Blkr.).

which is denticulated, is slightly shorter. Pectorals equal to head, their spine as long as the fin, denticulated at its inner border. Ventrals equal to eye, not reaching anal. Pearl-colored, back darker, distal part of dorsal, caudal, pectorals and ventrals blackish. Length 165 mm.

Nomen indig.: Lais (Sundan.).

Habitat: Java (Batavia, Tjikao, Parongkalong); Sumatra (Palembang, Lahat, Lematang Enim, Ringat!, Sidjundjung! Djambi!); Borneo. — Malacca.

In freshwater.

3. Helicophagus Blkr.

(Bleeker. Act. Soc. Sci. Indo-Neerl. III, 1858, p. 45).

Elongate, compressed, head covered by skin, conical with a pointed prominent snout; profile behind dorsal nearly straight, before the dorsal sloping downwards, more or less keeled by the occipital process and interspinal bone of the dorsal, which are more or less visible through the skin. Mouth subterminal. Anterior nostrils wide, surrounded by an elevated rim, situated at the top of the snout; looking forward or upwards. Posterior nostrils with an anterior lip, situated midway between anterior nostrils and eye. Eye at some distance behind and above the corner of the mouth, with a free orbital margin, more or less prominent on the eye. Four barbels, the maxillaries

above the corner of the mouth, the mandibulary barbels behind the symphysis. Dorsal well developped, with 6—7 soft rays and a strong flattened denticulated spine, which is preceeded by a broad but very low rudimentary spine. Adipose fin small. Anal fin elongate with 30 or more rays, distant from caudal, ventrals well developped with 6 rays, pectorals with a strong flattened denticulated spine. Caudal forked. Teeth in the jaws in a broad band or in the upper jaw in two separate patches, the vomerine teeth in two separate bands or patches. 9 branchiostegal rays; no teeth on the palatine. Gillmembranes united anteriorly, free from isthmus.

Fig. 102. *Helicophagus waandersi* Blkr.

Synopsis of the species.

I. Anal 30, more than thrice in length. Teeth in the upper jaw in a broad curved band . . . . . *H. typus* p. 252.

II. Anal 37 or more, $2^3/_4$ in length. Teeth in the upper jaw in two nearly quadratic patches. . . . . *H. waandersi* p. 253.

1. Helicophagus typus Blkr.

Helicophagus typus Bleeker, Act. Soc. Sci. Indo-Neerl. III. 1858, p. 46.
Helicophagus typus Bleeker, Atl. Ichth. II. 1862, p. 78.
Helicophagus typus Günther, Cat. Brit. Mus. V. 1864, p. 64.

B. 9; D. II. 6—7; A. 29—30; P. I. 11—13; V. 6.

Elongate, slightly compressed, head conical, profile behind dorsal nearly straight, before dorsal sloping down in a straight line to the prominent snout. Height behind dorsal about 5, head $4^3/_4$. Mouth subterminal. Anterior nostrils pierced through the frontborder of the snout and looking forward, posterior nostrils more distant from each other, halfway between the anterior ones and the eye. Maxillary barbels extending nearly to the pectoral spine, mandibulary barbels about $^1/_3$ longer.

Eye 5—7, situated in the second $^1/_4$ of the length of the head. Height of dorsal slightly less than head, its strong flattened spine slightly shorter, its hindborder denticulated. Adipose fin shorter than snout, situated above the beginning of the last $^1/_3$ of the anal, its height less than snout. Anal more than thrice in length. The outer longer rays of the anal nearly equal to postorbital part of head. Pectorals about as long as head without snout, their strong flattened spine somewhat shorter, their inner border denticulated. Three groups of 3—4 rather wide mucous pores in the axil of the pectorals. Cylindrical teeth with brown tips forming a broad curved band in the jaws, those of the vomer in two distant narrow curved bands. Pearlcolored, upper surface dark. Fins reddish, dorsal and margin of caudal dark. A whitish spot on the top of the head. Length over 460 mm.

Nomen indig.: Paten (Palembang).

Habitat: Sumatra (Palembang!).

In rivers.

2. **Helicophagus waandersi** Blkr. [Fig. 102 p. 252].

Helicophagus Waandersii Bleeker, Ichth. Arch. Ind. Prodr. I Siluri 1858, p. 175. Atl. Ichth. II. 1862, p. 77.

Helicophagus Waandersi Günther, Cat. Brit. Mus. V. 1864, p. 65.

B. 9; D. II. 6—7; A. 37—38; P. I. 10—11; V. 6.

Elongate, compressed, head conical, profile behind dorsal nearly straight, sloping down before dorsal in a straight line to the conical snout. Height $4^1/_2$—5, head a little more or less than 5. Mouth subterminal, snout soft, prominent, behind its frontborder pierced through by the wide anterior nostrils which look upwards and are surrounded by a prominent rim; posterior nostrils more distant from each other, situated midway between anterior nostrils and eye, with a valve at the frontmargin. Above the corner of the mouth a maxillary barbel extending on the pectoral; mandibulary barbels, originating close together at some distance behind the symphysis, somewhat shorter. Eyes more than 4, situated at the end of the first half of the head, somewhat shorter than snout. Height of dorsal about equal to head without snout, its spine somewhat shorter, very strong, flattened, the hindborder strongly denticulated; adipose fin above the last $^1/_3$ of the anal, its height nearly equal to snout; anal $2^3/_4$ in length. Ventrals

with the outer rays the longer, which are equal to postorbital part of head. Pectorals as long as head without snout, their spine slightly shorter, very strong, flattened, with the hindborder denticulated. A mucous porus in their axil. Teeth in the upper jaw in two nearly quadratic patches, in the lower jaw in two pearshaped patches with the point directed outwards and hindwards. Vomerine teeth in two very small, distant patches. Margaritaceous, above and anterior part of body blackish. Underside of head and belly white. Fins reddish, hindborder of dorsal and caudal dark. A whitish spot on the top of the head. Length 340 mm.

Nomen indig.: Patin muntjung (Djambi).

Habitat: Sumatra (Palembang, river Batang Hari, Djambi!). In rivers.

4. **Pangasius** Cuvier et Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poissons, XV. 1840, p. 45).

(*Pseudopangasius* Bleeker, *Neopangasius* Popta).

Elongate, compressed. Profile behind dorsal nearly straight, before dorsal sloping down in a straight line to the more or less prominent snout, which is generally rounded or bluntly pointed. Head covered by soft skin, by exception granulated above. Mouth subterminal, horizontal or slightly ascending. The wide anterior nostrils are situated at the top of the snout, looking forward; posterior nostrils with an anterior lip, situated at a short distance behind the anterior ones. Eye with a free orbital margin, behind corner of mouth, at least partly below the horizontal through the corner of the mouth. Four generally short barbels. The maxillary barbels originating in a slit above or behind the corner of the mouth and which is continued below the eye. Mandibulary barbels far behind symphysis. Dorsal well developped, with 6—7 rays, with a strong denticulated spine which is preceded by a broad but very low rudimentary spine and has a filamentous prolongation. Adipose fin small. Anal fin distant from caudal, elongate, with 28—40 rays. Ventrals with 6 rays. Pectorals with a strong denticulated spine. Caudal forked. Villiform teeth in the upper jaw in a slightly, in the lower jaw in a strongly curved band. Vomerine and palatine teeth in 4 patches, or

united into one, or only the vomerine patches united. 7—11 branchiostegals. Gillmembranes united, their hindborder deeply notched, free from isthmus.

Fig. 103. *Pangasius de Zwaani* M. Web. & de Bfrt.

Artificial key to the species.

I. Vomerine teeth united.

A. Vomerine teeth not confluent with the palatine teeth.

a. Band of vomerine teeth more than twice broader than long. A. 29—33.

α. Band of vomerine teeth thrice broader than long; snout very prominent; eye totally above level of corner of mouth . . . . . *P. nasutus* p. 256.

β. Band of vomerine teeth more than twice broader than long; snout slightly prominent; eye inferior, partly below level of corner of mouth . . . . . *P. pangasius* p. 256.

b. Band of vomerine teeth more than $1^1/_2$ times broader than long. A. 35—40 . . . . . *P. polyuranodon* p. 257.

B. Vomerine teeth confluent with the palatine teeth into one broad patch. . . . . *P. nieuwenhuisi* p. 258.

II. Vomerine teeth separate.

A. Barbels much longer than head. . . . . *P. macronema* p. 259.

B. Barbels much shorter than head.

a. Head 6 times, anal $3^1/_5$ times in length . . . *P. de Zwaani* p. 260.

b. Head $4^1/_2$—5 times, anal $3^1/_2$—4 times in length.

α. Maxillary barbels much more than half head. (see for this species also above under I. *A.*) . . . . . *P. pangasius* p. 256.

β. Maxillary barbels shorter than half head . *P. micronema* p. 261.

1. Pangasius nasutus (Blkr.).

Pseudopangasius nasutus Bleeker, Versl. Kon. Akad. Wet. Amsterdam, XV. 1862, p. 72. — Atl. Ichth. II. 1862, p. 76.
Pangasius nasutus Günther, Cat. Brit. Mus. V. 1864, p. 63.
Pangasius nasutus Vaillant, Nouv. Arch. Mus. Hist. Nat. (3). V. 1893, p. 72.
Pangasius nasutus Volz, Rev. Suisse Zool. XII. 1904, p. 466.

B. 9; D. II. 7; A. 29—31; P. I. 11; V. 6.

Elongate, slightly compressed. Profile behind dorsal nearly straight, before dorsal elevated, sloping down in a straight line to the broad prominent, rounded snout. Height below dorsal about 4, at the origin of anal $4^1/_2$—$5^1/_2$. Head 4, soft skin covers a rugose cask. Eye about 6, behind corner of mouth and above its level. Maxillary barbels originating above the corner of the mouth, in a slit which is continued below the eye; they extend to the base of the pectoral or not so far; the mandibulary ones somewhat shorter. First ray of dorsal much the longest, little shorter than head, osseous part of dorsal spine conspicuously shorter, about equal to head without snout, very strong, compressed, its hindborder with strong teeth. Adipose fin longer than eye, above the last $^1/_3$ of the anal, which goes 4 times in length and the anterior rays of which are equal to half head in height. Ventrals reaching the anal or nearly so, outer rays the longer, more than half of head. Pectorals equal to $^3/_4$ of head, their strong, flattened spine with the hindborder denticulated, conspicuously shorter. Caudal deeply incised with the lobes pointed. Villiform teeth in the upper jaw in a broad slightly rounded band, band in the lower jaw more curved. Vomerine band of teeth thrice or more than thrice broader than long, separated from the oblong palatine patches. Margaritaceous, upper surface of head, back and anterior part of body darkish. Fins reddish, dorsal, pectorals and distal part of caudal dark. Length 900 mm.

Nomen indig.: Patin (Sumatra).

Habitat: Borneo (river Barito, river Kapuas); Sumatra (river Kwantan, Batu Ridial, Indragiri, Batang Hari, Djambi!).

In rivers.

2. Pangasius pangasius (Ham. Buch.).

Pimelodus pangasius Hamilton Buchanan, Fishes of the Ganges, 1822, p.p. 186, 376.
Pangasius Buchanani Cuvier & Valenciennes, Hist. Nat. Poissons, XV. 1840, p. 45.
Pangasius djambal Bleeker, Nat. & Geneesk, Arch. Ned. Ind. III (2), 1846, p. 290. — Atl. Ichth. II. 1862, p. 73.

Pangasius buchanani Günther, Cat. Brit. Mus. V. 1864, p. 62.
Pangasius djambal Günther, Cat. Brit. Mus. V. 1864, p. 62.
Pangasius Buchanani Day, Fishes of India 4°, 1878—1888, p. 470.

B. 9—10; D. 1. 6—7; A. 30—33; P. 1. 12—13; V. 6.

Elongate, compressed posteriorly. Profile before dorsal slightly convex. Snout slightly prominent, obtusely rounded. Height at origin of anal $4^2/_3$—5. Head $4^1/_2$—$4^3/_4$, more or less granulated above. Occipital process more than twice as long as wide at its base. Eye 4—6, rather inferior, partly below level of corner of mouth, $2^1/_3$—4 in the interorbital space, shorter than snout. Maxillary barbels reach the base of the pectorals, the mandibulary barbels reach to the eye or to the operculum. Soft dorsal twice or more than twice as high as long, its spine $1^1/_2$—$1^1/_5$ in length of head, strongly serrated behind, less so anteriorly. Adipose fin more than twice as high as long. Anal nearly $3^1/_2$—$3^3/_4$ in length. Pectoral spine rather stronger than the dorsal one, equal to it or longer or shorter. Ventrals shorter than pectorals. Caudal deeply forked. Villiform teeth in rounded bands in the jaws, teeth on the palate in 4 distinct patches, the two vomerine patches may be confluent with each other or, according to Day, with the palatine patches. When in full grown specimens the vomerine teeth are confluent, they form an oblong, quadrangular patch, which is more than twice as broad as long. Silvery, back dark bluish. Fins hyaline, often more or less dusky. Length over 1200 mm. [Not seen by us].

Habitat: Java (Batavia, Krawang, Tjikao, Parongkalong). — British India, Assam and Burma.

In rivers and estuaries.

3. Pangasius polyuranodon Blkr.

Pangasius polyuranodon Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 425.
Pangasius juaro Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 589.
Pseudopangasius polyuranodon Bleeker, Atl. Ichth. II. 1862, p. 76.
Pangasius juaro Günther, Cat. Brit. Mus. V. 1864, p. 64.
Pangasius polyuranodon Kner, Novara-Exp. Fische, 1865—1867, p. 306.

B. 7—9; D. 11. 7; A. 35—40; P. 1. 12—13; V. 6.

Elongate, moderately compressed. Profile behind dorsal nearly straight, before the dorsal sloping down in a straight line. Snout prominent, broad, obtusely rounded. Anterior nostrils oval, quite in front of snout, posterior nostrils at some

distance behind, with an anterior lip. Eye $3^1/_2$ behind corner of mouth, about twice in the convexity of the interorbital space, somewhat less in their distance ventrally; its lower half below level of mouth, which is subterminal. Distance between corners of mouth $2-2^1/_2$ in head. Height $5-5^1/_3$, head $5^1/_5-5^1/_2$, covered by soft skin above. Maxillary barbels originating at the corner of the mouth, their anterior part hidden in a suborbital slit, extending to the axil of the pectorals or somewhat farther, mandibulary barbels longer than the eye. Dorsal with the first ray the longest, equal to head, its spine with a long filament, its osseous part nearly equal to head, flattened, with the hindborder denticulated, preceded by a broad but very short rudimentary spine. Adipose fin above the hindmost $^1/_6$ of the anal, shorter than the eye. Anal nearly thrice in length, ventrals shorter than head without snout, not reaching on anal. Pectorals shorter than head, their strong, flattened spine, denticulated at its hindborder, equal to head. Caudal deeply emarginate. Villiform teeth in the upper jaw in a slightly curved band, those of the lower jaw in a horseshoe-shaped band. Vomerine teeth, separate from the oblong palatine patches, in a broad nearly quadrangular patch, the greatest breadth of which is more than $1^1/_2$ its length. Pearl-colored with a silvery hue, upper surface blackish, fins yellowish, distal part of dorsal, ventrals, pectorals and caudal blackish, pectorals sometimes entirely black. Length over 500 mm.

Nomen indig.: Ikan juaro (Palembang, Banjuasin).

Habitat: Java; Sumatra (Palembang!, Banjuasin); Borneo (rivers Mahakam, Barito!, Kapuas, Baram, Limbang). — Siam.

In rivers.

4. **Pangasius nieuwenhuisi** (Popta).

Neopangasius Nieuwenhuisii Popta, Notes Leyden Museum XXIV. 1904, p. 180 and XXVII. 1906, p. 30.

D. 1. 7; A. 30; P. 1. 12; V. 6.

Height 4, head $4^5/_6$, covered by soft skin. Snout obtuse, broad, rounded, prominent. Eye $7^2/_3$, situated behind te corner of the mouth and partly below it. Interorbital space convex, $^5/_7$ in the length of the head. Maxillary barbels originating in a slit, commencing above the angle of the mouth and continued farther than hindborder of eye, the barbels nearly reaching base of pectoral. Mandibulary barbels $^3/_4$ of the length

of the maxillary ones. Dorsal equal to head, the osseous part of its spine, which is serrated behind, $^1/_5$ shorter. Adipose fin above the 21st or 22nd anal ray. Anal $3^1/_2$ in length. Caudal deeply bifurcated, upper lobe longer and more pointed than lower one. Ventrals reaching third anal ray, equal to half height of body. Pectorals a little longer than dorsal, their spine also longer than the dorsal one, denticulated behind. Teeth in the jaws in bands, that of the lower jaw more curved. Vomerine and palatine teeth granular, united in a large, rectangular group, two times broader than long, slightly convex anteriorly, slightly concave posteriorly. Upper surface dark violet-brown, sides greyish-silver, belly yellow. Fins red with a brown-violet margin. Length 600 mm. [After Popta; not seen by us].

Nomen indig.: "Lawang".

Habitat: Borneo (river Bŏ).

5. **Pangasius macronema** Blkr.

Pangasius macronema Bleeker, Nat. Tijdschr. Ned. Indië, I. 1851, p. 11. — Atl. Ichth. II. 1862, p. 74.

Pangasius macronema Günther, Cat. Brit. Mus. V. 1864, p. 62.

B. 10—11; D. II. 7; A. 30—31; P. I. 12; V. 6.

Elongate, compressed, dorsal profile nearly straight behind dorsal, sloping down in a straight line before the dorsal to the rounded, somewhat pointed, prominent snout. Mouthopening narrow, angular, slightly ascending. Distance between corners of mouth more than $^1/_3$ of head. Height behind dorsal $4^1/_4$—$4^3/_4$; head 5—$5^1/_5$, covered by soft skin. Eyes $2^1/_3$ to more than 3, situated behind the corner of the mouth, their lower half below a horizontal through the anterior part of the gape of the mouth, their dorsal distance conspicuously more than the ventral one. Maxillary barbels originating in a slit above the corner of the mouth, continued below the eye, extending to the end of the pectorals; mandibulary ones somewhat shorter. First dorsal ray much the longest, somewhat shorter than head, osseous part of its spine equal to head without snout, flattened, serrated posteriorly. Adipose fin shorter than eye, above the fourth $^1/_6$ of the anal, about thrice in length, its anterior rays much the longest, nearly equal to $^2/_3$ length of head. Caudal deeply emarginate. Ventrals distant from anal, equal to postorbital part of head. Pectorals shorter than head,

their spine of equal length, flattened, its hindborder serrated. Villiform teeth in the jaws in curved bands, on the vomer in 2 quadrangular patches, separated from the oblong palatine patches. Silvery; upper surface of head and back blackish, as also a band beginning at the opercle and running along the anterior third of the lateral line, rapidly diminishing in size, sometimes continued as a narrow line to the base of caudal. Fins yellowish, hindborder of caudal dark. Length about 180 mm.

Nomen indig.: Rios.

Habitat: Java?, Borneo (Banjermassin!).

In rivers.

6. **Pangasius de Zwaani** M. Web. & de Bfrt. [Fig. 103, p. 255].

Pangasius de Zwaani Max Weber & de Beaufort, in Maass, Durch Zentral-Sumatra II. 1912, Fische p. 14.

B. 9; D. II. 7; A. 34; P. I. 13; V. 6.

Elongate, compressed, dorsal profile straight behind dorsal, before dorsal sloping down in a straight line to the broad, slightly prominent snout. Mouthopening subterminal, somewhat oblique, curved, distance of corners of mouth slightly more than twice in length of head. Height nearly 5, head 6, covered by smooth skin. Eye slightly more than 4, shorter than snout, situated behind corner of mouth, its lower half below the horizontal through that corner, totally below the horizontal through the extremity of the mouth, more than thrice in the convexity of the interorbital space, more than twice distant from each other ventrally. Maxillary barbels, originating in a groove beginning behind corner of mouth and hidden in its continuation nearly to the hindborder of the eye, slightly longer than eye, the still weaker mandibulary barbels $^2/_3$ of eye. Dorsal equal to head, osseous part of its spine somewhat shorter, its hindborder serrated. Adipose fin shorter than eye, below posterior $^1/_3$ of anal, which goes $3^1/_5$ in length. Ventrals extending on anal, nearly as long as head without snout. Pectorals equal to head, their spine slightly shorter, with the hindborder denticulated. Villiform teeth in rather narrow bands in the jaws, that of the upper jaw slightly, that of the lower jaw strongly curved. Vomerine and palatine teeth in 4 approximated patches, arranged in a flat curve. Whitish, head, anterior part of body and back

blackish. Underside of head and fins reddish. Distal part of caudal, ventrals, pectorals and dorsal blackish. Marginal part of anal with a dark hue. Length 440 mm.

Habitat: Sumatra (Taluk!).

In rivers.

7. Pangasius micronema Blkr.

Pangasius micronemus Bleeker, Verh. Bat. Gen. XXI. I. 1847, Nieuwe Bijdr. Silur. Java, p. 8.

Pangasius rios Bleeker, Nat. Tijdschr. Ned. Indië, II. 1851, p. 205. — Atl. Ichth. II. 1862, p. 74.

Pangasius micronema Bleeker, Atl. Ichth. II. 1862, p. 75.

Pangasius rios Günther, Cat. Brit. Mus. V. 1864, p. 63.

Pangasius micronema Günther, Cat. Brit. Mus. V. 1864, p. 63.

Pangasius rios Vaillant, Nouv. Arch. Mus. Hist. Nat. (3) V. 1893, p. 71.

Pseudolais tetranema Vaillant, Notes Leyden Mus. XXIV. 1902, p. 29. (young specimen, type examined).

Pangasius rios Popta, Notes Leyden Mus. XXVII. 1906, p. 28.

B. 9; D. II. 7; A. 28—34; P. I. 11—14; V. 6.

Elongate, compressed, dorsal profile nearly straight behind dorsal, sloping down in a straight line before dorsal to the blunt, rounded, prominent snout. Mouthopening subterminal, semicircular, rather small. Distance between corners of mouth about 2—$2^1/_2$ in length of head. Height behind dorsal more than 4, head a little more or less than 5, covered by smooth skin above. Maxillary barbels originating behind the corner of the mouth, hidden in a slit, which is continued under the eye, shorter than half head; mandibulary ones a little less than $^1/_4$ of head. Eye 4—5, behind the corner of mouth and partly below it, about $3^1/_2$ times in the very convex interorbital space, about $2^1/_2$ times in the ventral distance. Osseous part of dorsal spine, which is of moderate strength and serrated behind, somewhat shorter than head without snout, adipose fin about equal to eye, above the beginning of the last $^1/_3$ of the anal. Anal $3^3/_5$—4 in length. Ventrals far distant from anal, about half length of head. Pectorals scarcely shorter than head, their spine somewhat shorter, serrated behind. Villiform teeth in the jaws in rather narrow bands, that of the lower jaw more curved. Teeth on vomer and palatines in four longish patches, arranged in a crescent. Margaritaceous, upper surface dark, fins yellowish, distal part of caudal, dorsal and sometimes nearly the whole pectorals blackish. Length over 500 mm.

Nomen indig.: Wakkal (Java), Rios tjaring (Banjermassin), Lantjang (Mahakam), Juara (Djambi).

Habitat: Java (Surakarta, Wonogiri, Kediri!, Gempol, Surabaya!); Sumatra (Djambi!); Borneo (rivers Kapuas, Barito, Mahakam!).

In rivers.

Doubtful species.

About *Pangasius delicatissimus* Blkr., recorded by Bleeker in a note on p. 73, Atlas ichthyologique II, 1862, from Krawang, Java, nothing else is known besides his very short description after a drawing, made by an artist of the former „Commission for natural history research in Netherlands India". The „bandelette nacrée qui commence sur le museau, monte vers la tempe et suit la courbure du dos jusque près de la nageoire caudale" which distinguishes it according to Bleeker from all other species of *Pangasius*, exists, after our observation, also in *P. macronema*.

6. Fam. Bagaridae.

Dorsal fin short, with a pungent spine and 6—7 soft rays, placed anteriorly on the trunk in advance of the ventrals. Adipose fin equal to anal and opposite to it. Lower surface of head and abdomen flat. Paired fins horizontal. Pectorals with a pungent spine. Ventrals 6-rayed. Caudal forked. Eyes subcutaneous. Anterior and posterior nostrils placed close together, a membranaceous fold with a short nasal barbel between them. Mouth transverse or crescentic, at the lower side of the snout, the upper jaw being prominent. Eight barbels, a pair of small nasal ones, maxillary pair with a stiff base, a mandibulary and a mental pair in a curved or transverse line. Palate edentulous. Small teeth, sometimes mixed with larger ones, in bands on the jaws. Gillmembranes confluent with the isthmus or free. 5—12 branchiostegals.

Key to the genera.

I. A thoracic adhesive apparatus between the pectorals composed of longitudinal plaits of the skin . . . . . *Glyptosternum* p. 263.

II. No adhesive apparatus.

A. Head compressed, gillmembranes confluent with

skin of isthmus. Mandibulary and mental barbels in a transverse series . . . . . *Gagata* p. 268.

B. Head depressed. Mandibulary and mental barbels situated in a curved line . . . . . *Bagarius* p. 269.

1. Glyptosternum McClelland.

(Mc Clelland. Calcutta Journ. Nat. Hist. II, p. 584).

(*Glyptothorax* Blyth, Bleeker).

Head rather depressed and covered with soft skin. Eyes small, subcutaneous, looking upward. Mouth transverse, with the upper jaw conspicuously longer. Nostrils close together, separated by the short nasal barbel. Maxillary barbels very broad at the base. Mandibulary barbels behind level of corner of mouth, the shorter mental ones between them. Short dorsal with a pungent spine and 6 rays. Adipose fin rather short, above the short anal. Ventrals six-rayed, originating behind or below last dorsal ray. Pectorals horizontal with a strong denticulated spine. Caudal forked. Between the bases of the pectorals a thoracic adhesive apparatus, composed of longitudinal plaits of the skin [1]). Gillopenings wide. Palate edentulous. Teeth of the jaws in a villiform band. Gillmembranes confluent with the skin of the isthmus. 8—9 branchiostegals.

Synopsis of the species.

A. Height 5 or more.

1. Caudal peduncle nearly as long as high. Occipital process 2 times longer than broad.

a. Origin of ventrals far behind end of base of dorsal; distance between dorsal and adipose fin more or less twice the length of the adipose fin . . . . . *G. platypogon* 264.

b. Ventrals totally below dorsal; distance between dorsal and adipose fin shorter than adipose fin . . . . . *G. baramensis* p. 265.

2. Caudal peduncle more than twice as long as high. Occipital process 3—4 times longer than broad . . . . . *G. platypogonoides* p. 267.

B. Height 4—4½. Caudal peduncle twice or less than twice as long as high . . . . . *G. majus* p. 267.

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1) This apparatus may get indistinct by preservation.

1. Glyptosternum platypogon (C. V.) [Fig. 104].

Pimelodus platypogon Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 152.
Pimelodus cyanochloros Bleeker, Verh. Bat. Gen. XXI. I. 1847, Nieuwe Bijdr. Sil. Java p. 11.
Glyptothorax platypogon Bleeker, Atl. Ichth. II. 1862, p. 63.
Glyptosternum platypogon Günther, Cat. Brit. Mus. V. 1864, p. 187.
Glyptosternum Kükenthali Steindachner, Abh. Senckenb. Nat. Gesell. XXV. 1901, p. 448 [1]).
Glyptothorax platypogon Fowler, Proc. Acad. Nat. Sc. Phil. (2) LVII. 1905, p. 470.
Glyptosternum platypogon Popta, Notes Leyden Mus. XXVII. 1906, p. 79.

Fig. 104. *Glyptosternum platypogon* (C. V.). The figure of the anterior part, seen from below, shows the thoracic adhesive apparatus. nat. size.

B. 8—9; D. I. 6; A. 4. 7—9; P. I. 7—10; V. I. 5.

Height 5—5$^2/_3$, head 3$^1/_2$—4$^1/_3$, eye 8—11. Snout half as long as head or a little shorter, interorbital space nearly as long as the distance of the anterior nostril from the eye, nasal barbel equal to $^2/_3$ of lastnamed distance. Maxillary barbels extending on the pectorals, mandibulary ones to the end of the head, mental ones considerably shorter. Occipital process about twice as long as broad. Dorsal about as high as head without snout, in smaller specimens higher; its spine in the first case longer, in the second case much longer than half of the head. Distance of dorsal to adipose fin, according to size, more or less than twice the length of lastnamed fin. Anal lower than dorsal. Ventrals rounded, equalling dorsal

1) *Glyptosternum Kükenthali* Steindachner, from Baram river, Borneo, is probably an exceedingly large specimen (267 mm.) of *G. platypogon*. See also Fowler l. s. c.

in length, their origin far behind end of base of dorsal. Hindborder of pectorals concave, their longest ray equalling the distance from anterior nostril to hindborder of operculum, their broad and very strong pectoral spine much shorter, very strongly denticulated at its inner border. Longest rays of caudal as long as or a little shorter than head. Least height of caudal peduncle a little shorter than its length. Gillrakers 8. Lighter or darker olivaceous brown, often with dark spots scattered over the back; belly, underside of head and ventral barbels whitish. Rayed fins of the same colour, their base and irregular peripherical patches dark. Base of caudal dark. Length 100 mm. (*G. kükenthali* 267 mm.).

Nomen indig.: Djengal (Sundan.); Leleh-gunong (Batav.); Pitang (Javan.); Senggaringan (Djocja); Kegkel (Pangerango).

Habitat: Java (Batavia, Buitenzorg!, Pangerango!, Tjampea, Tjipanas, Passir Datar!, Tjibodas!, Tjandjur, Parongkalong, Garut!, Sukabumi!, Surakarta, Djocja!, Malang, Ngantang, Djember!); Sumatra (Pajakombo, Deli!); Borneo (Kajan, Baram, Dapor and Rijang-rivers).

In brooks and rivers, specially in mountain streams.

2. **Glyptosternum baramense** (Fowler).

Akysis baramensis Fowler, Proc. Acad. Nat. Sci. Phil. (2) LVII. 1905, p. 472.

D. I, I, 5; A. II, 6, II; P. I, 5, II; V. I, 5.

„Head $3^1/_2$; depth $5^1/_2$; width of head $1^1/_4$ in its length; depth of head $1^2/_3$; width of mouth 2; length of snout $2^3/_4$; interorbital space 3; length of depressed dorsal $1^1/_6$; of lower caudal lobe 1; of pectoral $1^1/_{10}$; ventral $1^2/_3$; least depth of caudal peduncle $2^4/_5$.

Body elongate, slender, depressed, and greatest depth about opposite middle of depressed pectoral. Caudal peduncle compressed, its least depth about $1^2/_3$ in its length from posterior base of adipose dorsal fin.

Head broad, depressed, evenly convex above, and lower portion more or less flattened. Breast flattened. Snout produced, broad and rounded convexly in profile when viewed from above. Eye small, superior, anterior, and eyelid not developed. Mouth broadly convex inferior, and in profile tip of mandible would fall in first $^2/_5$ of space between tip of snout and front of eye. A band of fine teeth in each jaw, none on roof of

mouth or on tongue. Tongue broad, smooth and little free in mouth. Two large nasal cavities on side of snout in front of eye near together, and nasal barbel originating on frenum between. Nasal barbel about equal to ventral or reaching for about first $^{2}/_{3}$ of length of head. Maxillary barbel rather thick at first and reaching about first third of depressed pectoral. Outer mental barbel nearly as long. Inner mental barbel a little over half length of outer. Interorbital space flattened. Occipital process not forming a complete bony bridge to spinous process of dorsal.

Gill-openings inferior, well separated by a broad isthmus, and extending forward about opposite to eye. Rakers about 1 + 7, slender, pointed, moderately long, and much shorter than filaments. Branchiostegals 7, upper clavate.

Skin smooth, on head and along lateral line more or less papillate, especially former anteriorly. Lateral line complete and median in depth of body along side.

First dorsal inserted about first third of total length of fish, spine robust and about $^{3}/_{5}$ of its own length when combined with adipose-like prolongation, and smooth. When depressed it reaches about $^{3}/_{4}$ of space to origin of adipose fin. Adipose fin large, rather high, and its base about $1^{3}/_{5}$ in head. Anal high, its origin a trifle in advance of that of adipose fin and when depressed its length a little more than that of dorsal. Pectoral a little longer than dorsal, and spine robust with posterior margin coarsely serrate, with an adipose-like prolongation. When depressed not quite reaching opposite posterior basal margin of dorsal, though beyond origin of ventral. Ventral not quite reaching origin of anal. Vent well forward or close behind roots of ventrals.

Color in arrack dusky-brown, forming about five blotches transversely on body, and mostly above. First included in head, second below dorsal, third below adipose fin, fourth on caudal peduncle at base of caudal and fifth on caudal distally. These all connected along middle of side of body by isthmi of same color. Dorsal dusky-brown. Adipose fin largely dusky-brown. Adipose fin largely dusky-brown. Caudal except as noted whitish, and tip of each lobe same. Ventral and anal whitish, except a small dusky blotch on each medianly. Pectoral with spine whitish, fin otherwise dusky. Lower surface of body, including head and abdomen principally, whitish.

Paler areas on upper surface of body brownish-white. Iris slaty. Nasal and maxillary barbels whitish mostly, brownish above, and mental barbels entirely white".

Length ± 47 mm. [After Fowler, not seen by us].

Habitat: Borneo (Baram river).

3. Glyptosternum platypogonoides (Blkr.).

Pimelodus platypogonoides Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 272.
Glyptothorax platypogonoides Bleeker, Atl. Ichth. II. 1862, p. 63.
Glyptosternum platypogonoides Günther, Cat. Brit. Mus. V. 1864, p. 186.

B. 8—9; D. I. 6; A. 3—4. 9; P. I. 9; V. I. 5.

Height 5—$5^1/_2$, head $4^2/_5$, eye 8—11. Snout half as long as head, interorbital space about as long as distance from eye to posterior nostril, nasal barbels equal $^2/_3$ of lastnamed distance. Maxillary barbels extending to the pectorals, mandibulary ones as long as the head, mental ones much shorter. Occipital process 3—4 times longer than broad. Height of dorsal about $^3/_4$ of head, the osseous part of its spine $^2/_3$ of head, in large specimens somewhat longer, weakly denticulated behind. Length of adipose fin 1—2 in its distance from the dorsal, according to size of specimens. Anal distinctly lower than dorsal. Origin of ventrals about below end of base of dorsal. The pectorals longer than ventrals, the length of the longest ray of pectorals equalling distance from anterior nostril to hindborder of operculum, their spine very broad and strong, strongly denticulated behind, longer than half head. Caudal deeply forked, its longest rays much longer than head. Lowest part of caudal peduncle equalling twice its length. Gillrakers 8. Colour uniform brown, underside lighter, fins each with an indication of a broad dark band. Length 120 mm.

Habitat: Sumatra (Lahat, Deli!).

In freshwater.

4. Glyptosternum majus (Blgr.).

Akysis major Boulenger, Ann. Mag. Nat. Hist. (6) XIII. 1894, p. 246 [1]).
Glyptosternon platypogonoides Vaillant, Nouv. Arch. Museum Hist. Nat. (3) V. 1893, p. 73. (nec Blkr.).
Glyptosternon Nieuwenhuisi Vaillant, Notes Leyden Mus. XXIV. Nov. 1902, p. 72.

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1) See Tate Regan, Ann. Mag. Nat. Hist. (8). VIII. 1911, p. 563.

Glyptosternum laak Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 190. — o. c. XXVII. 1906, p. 71.
Glyptosternum tiong Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 191. — o. c. XXVII. 1906, p. 75.

D. I—II. 6; A. 4. 10—11; P. I. 7—9; V. I. 5.

Height about 4—4 1/2, head 3 2/3 to about 4, eye 8 1/2—11, situated about in the middle of head, about 3—4 in the interorbital space. Nasal barbels short, 2—2 1/2 times diameter of eye and not reaching it. Maxillary barbels extending to or reaching a little farther than base of pectorals, mandibulary barbels surpassing the gillmembrane, the mental ones a little shorter. Occipital process 3 times longer than broad. Dorsal and adipose fin equally long. The interspace between these fins is about 1 1/2—2 their length and in that interspace may be visible, according to the mode of preservation, 5—6 tuberosities, corresponding to the end of the dorsal processes of the underlying vertebrae. The height of dorsal is about 6/7 the length of the head, its spine is somewhat shorter, the hindborder of which is more or less denticulated. Ventrals shorter than pectorals, their origin below or slightly behind end of base of dorsal. Pectorals reaching to ventrals or nearly so, their spine very large, flat, strongly denticulated behind, somewhat shorter or about as long as the dorsal. Axillary pore present. Caudal deeply forked, about as long as head. Least part of caudal peduncle 1 1/3—2 times its length. Colour greyish or reddish marbled or clouded with brown or yellow and freckled with black. Belly and underside of head and hindborder of fins yellowish. Length 144 mm. [Types of Vaillant and Popta seen in Leyden Museum].

Nomen indig.: Laak (riv. Howong); Sikèn (riv. Bŏ); Tiong (riv. Kajan).

Habitat: Borneo (rivers Howong, Bŏ, Kajan, Bluū, Sebruang, Senah, Tagora and Baram).

In rivers.

2. **Gagata** Bleeker.

(Bleeker. Ned. Tijdschr. Dierk. I. 1863, p. 90).

(*Callomystax* Günther).

Compressed. Mouth small, transverse at the lower side of the snout. The intermaxillaries and mandibularies being short, small. Upper surface of head with sharp longitudinal ridges

and covered by thin skin. Eyes covered by skin. Nostrils close together, separated by a nasal barbel. Maxillary barbels with a broad basal membrane and proximally osseous. The 4 mandibular and mental barbels in a transverse line, close behind the border of the lower jaw. The short dorsal fin with a strong spine. Adipose fin of same length. Anal fin rather short and high. Caudal fin deeply forked. Ventrals horizontal, 6-rayed, inserted far behind the origin of the dorsal. Pectorals horizontal with a strong spine. No teeth on palate, those in the jaw small and villiform. Gillopenings separated by a rather narrow isthmus, with which the gillmembranes are confluent. 5—7 branchiostegals.

1. Gagata Schmidti Volz.

Callomystax Schmidti Volz, Revue Suisse de Zool. XII. 1904, p. 470.

D. I. 6; A. 13; P. I. 10; V. 6.

Height $5^1/_2$—$6^1/_4$, head 4—$4^1/_3$, depressed, $1^1/_2$ times broader than high. Length of occipital process equal to its distance from the anterior nostril, about two times as long as broad. No fonticulus visible. Eye 13, situated on the upperside of the middle of the head. Nasal barbels a little shorter than the interorbital space, maxillary barbels extending to the end of the head or a little farther. Mandibulary barbels half the mentals, about $^1/_3$ of the length of the maxillary ones. Height of dorsal fin more than height of head. Dorsal spine $^1/_3$ lower. Its front and hindborder dentated, with exception of its upper-part. Distance of adipose fin from dorsal $2^1/_3$ times its length. Pectorals longer than ventrals, equal to head, their spine curved, flat, stronger than but as long as the dorsal one, its hindborder with strong teeth. Lower lobe of caudal the longer. A conspicuous lateral line. Uniform grey brown, fins somewhat lighter. Rays of dorsal darker in their median part. Length 100 mm. [After Volz, not seen by us].

Habitat: Sumatra (Simbolan hills, 1400 M. high).

3. Bagarius Bleeker.

(Bleeker, Verh. Bat. Gen. XXV. 1853, Nalez. Ichth. Bengalen, p. 121).

Head depressed, its upper surface naked and osseous. Mouth crescentic, with the upper jaw strongly projecting. Nostrils close together, separated by a membranaceous fold with a

very short nasal barbel. Maxillary barbels very broad, acutely tapering behind, the much shorter mandibulary ones before corner of mouth; they are slender and flattened as also the still shorter mental ones, which are situated before and between them. No free orbital margin. Eyes superior. Dorsal 6-rayed with a strong, pungent spine. Adipose fin above short anal and equal to it. Ventrals 6-rayed and originating behind dorsal. Pectorals with a flattened, strong, pungent spine. Dorsal and pectoral spines as well as the lobes of the deeply forked caudal, produced into long filaments. No thoracic adhesive apparatus. In the upper jaw a broad crescentic band of unequal teeth, the band in the lower jaw much narrower and with a series of strong, curved teeth. All the teeth are depressible. Palate edentulous. Gillopening wide. Gillmembranes anteriorly united, deeply emarginate, free from isthmus. Branchiostegals 12.

Fig. 105. *Bagarius bagarius* (Ham. Buch.). × 1/4.

1. Bagarius bagarius (Ham. Buch.).

Pimelodus bagarius Hamilton Buchanan, Fishes Ganges, 1822, p. 186, 378.
Bagarius Yarelli Sykes, Trans. Zool. Soc. London, II. 1841, p. 370.
Bagarius Buchanani Bleeker, Verh. Bat. Gen. XXV. 1853, Nalez. ichth. Bengalen, p. 121. — Ichth. Arch. Ind. Prodr. I Siluri. 1858, p. 212. — Atl. Ichth. II. 1862, p. 61.
Bagarius yarellii Günther, Cat. Brit. Mus. V. 1864, p. 183.
Bagarius Yarrellii Day, Fishes of India 4°. 1878—1888, p. 495.
Bagarius lica Volz, Zool. Anz. XXVI. 1903, p. 557. — Zool. Jahrb. Abth. Syst. XIX. 1903, p. 391.

Bagarius Nieuwenhuisii Popta, Notes Leyden Museum, XXIV. Jan. 1904, p. 190 and XXVII. 1906, p. 66.

Bagarius bagarius Max Weber & de Beaufort, in Maass „Durch Zentral-Sumatra" Bd. II. 1912, Fische p. 16.

B. 12; D. I. 6; A. 12—15; P. I. 12; V. 6.

Height 5—7. Head $3^1/_3$—$3^1/_2$. Eye small, situated in the beginning of the posterior half of the head. Maxillary barbels reaching on pectorals or not so far. Dorsal spine nearly equal to snout and eye, about as long as the pectoral spine, the hindborder of which is strongly denticulated. Greyish or yellowish, with large, irregular black bands and markings. All the fins with a black base and a black intermarginal band or black spots. A nearly uniformly coloured variety has been described as *B. nieuwenhuisii*. Length more than 2000 mm.

Nomen indig.: Kelaling (Javan.), Lika (Sundan., Malay.), ketŏ, ketŏ lawang, ketŏ langit (Mahakam).

Habitat: Java (Parongkalong, Trogon, Surakarta); Sumatra (rivers Musi and Kwantan!); Borneo (rivers Mahakam and Kapuas). — Burma, Tonkin, British India.

In rivers, descending to estuaries.

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7. Fam. Ariidae.

Dorsal fin short, with a pungent spine placed anteriorly between pectorals and ventrals, which have 6 rays. Adipose fin shorter than dorsal, opposite to anal, which has 14—26 rays. Pectorals lateral, rather low down, with a pungent spine. Caudal forked. Head more or less depressed or conical, covered by skin or with the headshields conspicuous. Nostrils close together, the posterior with a valve but without a barbel. Generally maxillary, mandibulary and mental barbels, or only the maxillary or only the mandibulary ones are present. Eyes sometimes subcutaneous, in most cases with a free orbital margin. Mouth wide or narrow, transverse or crescentic, at the lower side of the snout, the upper jaw more or less prominent. Teeth on palate villiform, conical, granular or absent; in the jaws villiform, conical or incisor-like, in one or more series, in bands or in patches. Gillmembranes united and connected with isthmus. Branchiostegal rays 5—9.

Artificial key to the genera.

I. Maxillary and mandibulary barbels present.

1. Teeth on palate present. . . . . *Arius* p. 272.

2. Palate edentulous.

a. Mouth wide, reaching behind eye. Closely set incisor-like teeth in a single series in the jaws. . . . . *Ketengus* p. 317.

b. Mouth narrow, ending before eye. No incisor-like teeth in the jaws.

α. A narrow patch of conical teeth, few in number, on each side of the jaws. 8 short gillrakers. Gillmembranes with free posterior margin. . . . . *Tetranesodon* p. 318.

β. Minute teeth in 1 or 2 series in the jaws. More than 30 long gillrakers. Gillmembranes totally confluent with skin of isthmus, without free posterior margin . . . . *Nedystoma* p. 320.

γ. Bands of villiform teeth in the jaws. Gillrakers short, few or moderate in number. Gillmembranes with free posterior margin. *Hemipimelodus* p. 322.

II. Only a pair of stiff, osseous, maxillary barbels present . . . . . *Osteogeneiosus* p. 329.

III. Only a pair of small mandibulary barbels developed *Batrachocephalus* p. 331.

1. Arius Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 53).

Elongate, posteriorly compressed. Head dorsally with more or less granular or rugose osseous shields. Occipital process touching the basal bone of the dorsal spine. Upper jaw projecting before moderate or large transverse or arcuate mouth, wich has thin lips. Nostrils close together, the posterior with a valve, situated superiorly near the frontborder of the snout. Eyes lateral or slightly directed upward, with a free orbital margin. A pair of maxillary, mandibulary and mental barbels. A short dorsal with 7 rays and a pungent spine, situated between pectorals and ventrals. Adipose fin short or of moderate length, opposite to short anal. Pectorals with a pungent spine. Caudal forked, with rounded or acute lobes. Teeth in the jaws in bands, on the palate villiform, granular

or conical in one, two or three groups on each side. Gill-membranes united, connected with the isthmus but with a free posterior margin. 5—9 branchiostegals.

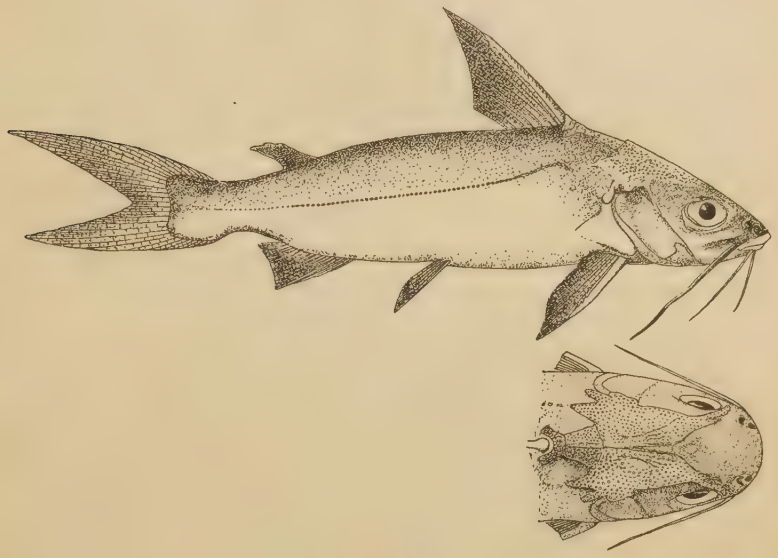

Fig. 106. *Arius thalassinus* (Rüpp.).

Synopsis of the species.

I. Teeth on the palate granular.

A. Teeth in four groups (the anterior groups sometimes rudimentary). (*Ariodes* Blkr.).

1. posterior patches in a broad oval, converging behind.

a. anterior patches well developed, sides of occipital process convex . . . . . *A. crossocheilus* p. 276.

b. anterior patches rudimentary or nearly wanting, sides of occipital process straight.

α. head 3 times in length . . . . . *A. macrocephalus* p. 277.

β. head more than 3 times in length. . *A. argyropleuron* p. 278.

2. posterior patches in a narrow oval, parallel or diverging behind.

a. parallel, occipital process with irregular convex sideborders, its hinderhalf triangular . . . . . *A. polystaphylodon* p. 280.

b. diverging behind.

α. occipital process oval . . . . . *A. leiotetocephalus* p. 282.

β. occipital process triangular with straight sideborders . . . . . *A. goniaspis* p. 283.

B. Teeth in two groups [1]). (*Pseudarius* Blkr.).

1. teeth in the upper jaw in a band, at least 6 times as long as broad . . . . . *A. maculatus* p. 284.

2. teeth in the upper jaw in a band, 3 times as long as broad . . . . . *A. microcephalus* p. 285.

II. Teeth on the palate villiform, or conical and pointed.

A. Teeth in three groups on each side, forming a large triangular patch with the base anteriorly (*Netuma* Blkr.). . . . . *A. thalassinus* p. 286.

B. Teeth in two groups on each side in a transverse row. (*Hexanematichthys* + *Hemiarius* Blkr.).

1. outer groups triangular with emarginate hindborder, greatly exceeding in size the very small contiguous inner groups. . . . . *A. gagorides* p. 288.

2. outer groups rounded or oval, larger than the inner groups which are generally distant.

a. occipital process hemispherically rounded *A. sagor* p. 289.

b. occipital process more or less triangular.

α. base of adipose fin longer than that of dorsal, twice or less in its distance from that fin.

α'. Dorsal spine as long as head from nostrils . . . . . *A. stormi* p. 291.

β'. Dorsal spine as long as postorbital part of head [2]).

a^1. Head 4–$4^2/_3$ in length. Pectoral spine as long as head without snout, longer than dorsal spine *A. carinatus* p. 292.

b^1. Head 3 in length. Pectoral spine shorter than half head and shorter than dorsal spine.

a^2. eye $9^1/_2$–$11^1/_2$ in head, base of occipital process $^2/_3$ of its length . . . . . *A. nudidens* p. 294.

b^2. eye $6^1/_4$, base of occipital process $^1/_2$ of its length. . *A. spatula* p. 296.

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1) In using this table one ought to remember that in some cases the anterior patches of teeth on the palate may be rudimentary or the teeth nearly wanting, with the result that there seem to be only two patches in all.

2) In young specimens of *A. nudidens* the dorsal spine is 1 eye-diameter longer.

β. base of adipose fin shorter than that of dorsal, more than 2 times in its distance from that fin.

α'. teeth on palate in a continuous row of square patches without median interspace . . . . . *A. latirostris* p. 296.

β'. teeth on palate in a row of 4 patches, the median ones being separated by an interspace at least half their length.

a^1. Dorsal spine much longer than that of P. and as long as head from nostrils . . . . . *A. stirlingi* p. 297.

b^1. Dorsal spine equal to or shorter than that of P. and at most as long as head without snout.

a^2. adipose fin about 5 times in its distance from dorsal, opposite to hinderhalf of anal *A. danielsi* p. 300.

b^2. adipose fin $2^1/_2$–4 times in its distance from dorsal, above anterior half or middle of anal.

a^3. occipital process with the sideborders slightly converging, nearly parallel. 9 gillrakers . . . . . *A. acrocephalus* p. 302.

b^3. occipital process triangular, with the sideborders conspicuously converging. 12 gillrakers . . . . . *A. leptaspis* p. 303.

C. Teeth in one group on each side.

1. median fontanel on upper surface of head posteriorly broad, heart-shaped, with a smaller ovate one on each side. Hindborder of dorsal spine with the dentation partly directed upward. (*Cephalocassis* Blkr.) *A. melanochir* p. 305.

2. median fontanel not broadened posteriorly. (*Arius* Blkr.).

a. teeth on palate in a pearshaped patch with the points directed backwards, the long axes converging backwards. . . . . *A. leptonotacanthus* p. 306.

b. teeth on palate in ovate patches, the

long axes of which converge more or less anteriorly.

α. patches implanted upon a movable cushion [1]). . . . . *A. froggatti* p. 307.

β. patches not movable.

α'. long axes of patches, which are slightly longer than broad, meet anteriorly in an acute angle . . . *A. truncatus* p. 308.

β'. ovate patches twice as long as broad, their long axes meeting anteriorly in a very blunt angle. *A. macronotacanthus* p. 309.

c. teeth on palate in more or less triangular patches, the base of which is directed anteriorly.

α. headshields granular, pectoral spine shorter than that of the dorsal . . . *A. coelatus* p. 310.

β. headshields smooth or nearly so, pectoral spine as long as that of the dorsal.

α'. head $3^1/_4$—$3^1/_2$, dorsal spine shorter than head without snout, eye about 5. . . . . *A. utik* p. 312.

β'. head $3^1/_3$, dorsal spine longer than head without snout, eye 8—9. . *A. doriae* p. 313.

γ'. head about 4, dorsal spine equal to head from nostril, eye 4–$4^1/_2$ *A. venosus* p. 314.

1. Arius crossocheilus Blkr.

Arius crossocheilos Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 137.
Arius tonggol Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 292.
Ariodes tonggol Bleeker, Ichth. Arch. Ind. Prod. I Siluri, 1858, p. 83. — Atl. Ichth. II. 1862, p. 39.
Arius tonggol Günther, Cat. Brit. Mus. V. 1864, p. 164.

B. 6; D. I. 7; A. 18; P. I. 11; V. 6.

Elongate, height about 5, head $3^1/_2$, much broader than high, its width about $^2/_3$ of its length. Headshields with radiating roughened or granulated lines. The granulated occipital process is triangular, somewhat longer than broad at its base, elevated mesially and less than twice as long as broad in its middle, its sides convex, the narrow hindborder touches the granulated narrow basal bone of the dorsal, which has wing-

1) according to J. Douglas Ogilby.

like extremities. When young the occipital process is strongly carinated and narrow. The median fontanel begins on the snout, ends before the occipital process and is broadest in the middle. Dorsal profile sloping down in a straight line to the somewhat conical, rounded, slightly prominent snout. Eyes with a free orbital margin, 5—6, situated about in the middle of the head, in young less than twice, in full grown specimens more than twice in the snout, nearly 3 times in the interorbital space. The maxillary barbels extend on pectorals in young, in old specimens not quite to base of pectorals; mandibulary ones to hindborder of gillmembranes, mental ones not so far. Height of dorsal more than $^2/_3$ of head; dorsal spine nearly equal to head without snout, its frontborder granular and serrated at the top as also the whole hindborder. Adipose fin small, its base much less than that of soft dorsal, 5 to more than 6 times in its distance from dorsal. Anal concave. Ventrals distant from origin of anal, much shorter than pectorals, the length of which is equal to head without snout; pectoral spine flattened, serrated at both sides, stronger than and as long as the dorsal one. Sharp villiform teeth in the jaws in an arcuate band; those on the palate globular, in 4 separate patches: two small ones widely separate anteriorly, 2 large pearshaped ones posteriorly, their long axis converging behind. About 9 stiff, somewhat flattened gillrakers, much shorter than branchial filaments. Bluish brown above, silvery white below, fins yellowish with more or less distinct dusky margins. Length 375 mm.

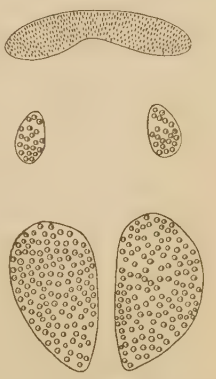


Fig. 107. *Arius crossocheilus* Blkr. Teeth of upper jaw and palate $^1/_1$.

Nomen indig.: Ikan manjong utik (Malay. Batav.).

Habitat: Java (Batavia); Sumatra (Padang, Trussan); Bintang; Banka; Celebes (Bay of Boni!). Philippines.

In sea.

2. Arius macrocephalus Blkr.

Arius macrocephalus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 167, ibid. p. 287.

Ariodes macrocephalus Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 85. — Atl. Ichth. II. 1862, p. 39.

Arius macrocephalus Günther, Cat. Brit. Mus. V. 1864, p. 165.

B. 6; D. I. 7; A. 20—21; P. I. 11; V. 6.

Elongate, height 5, head 3 or a little less, much broader than high, its width is $^3/_5$ of its length. Occipital process carinated, longer than broad, somewhat triangular, its lateral margins nearly straight, about twice longer than broad in its middle, its hindmargin broad, touching the narrow crescentic basal bone of the dorsal, both irregularly granulated, a few granulations also on the occipital bone. Median fontanel beginning behind snout and ending before the occipital process, broadest in the middle. Dorsal profile sloping down very slightly to the bluntly rounded, prominent snout, with a very feeble convexity. Eyes with a free orbital margin, $6^1/_2$—7, situated slightly before the middle of the head, $2^2/_3$ in snout, 3 times in the convex interorbital space. Maxillary barbels nearly reach the hindborder of the head, mandibulary barbels extending to gillmembrane, mental ones not so far. Height of dorsal equal to head without postorbital part, its spine $1^1/_2$—$1^3/_5$ in head, granulated in front, weakly serrated behind. Adipose fin very small, its base much less than that of the dorsal and about $4^1/_2$ times in its distance from that fin. Ventrals do not reach anal and are much shorter than pectorals, the length of which is nearly equal to the head without snout, their flattened spine somewhat shorter, its frontborder corrugated, denticulated distally, as is also its hindborder. 10 short, stout gillrakers. Villiform teeth in an arcuate band in the jaws, granular teeth far backward on the palate in two oval patches, the long axis of which converge hindward. Two small patches in front on the palate, reduced to a few small teeth or even wanting. Brownish above, silvery white below. Fins hyaline, adipose fin with a black spot. Length 401 mm. [One of Bleeker's specimens examined in the Leyden Museum].

Nomen indig.: Manjong utik (Malay. Batav.).

Habitat: Java (Batavia, Penandjung Bay!).

In sea.

3. Arius argyropleuron C. V.

Arius argyropleuron Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 104.
Arius acutus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 167.
Arius Hamiltonis Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 291.
Arius argyropleuron Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 86.
Ariodes argyropleuron Bleeker, Atl. Ichth. II. 1864, p. 40.
Arius argyropleuron Günther, Cat. Brit. Mus. V. 1864, p. 164.

? *Arius argyropleuron* Steindachner, Sitzber. Akad. Wien LVII. 1868, p. 1003.
Tachysurus argyropleuron Fowler, Proc. Acad. Nat. Sci. Phil. (2) LVII. 1905, p. 462.
Arius argyropleuron Seale, Philippine Journ. Science V. 1910, p. 266.

B. 6; D. I. 7; A. 19—20; P. I. 11; V. 6.

Elongate, height $4^3/_4$—5, head $3^1/_2$, much broader than high, its width about $^2/_3$ of its length. Headshields with roughened and granulated lines. Occipital process carinate in young specimens, longer than broad, its lateral margins straight, twice or more than twice longer than broad in its middle, touching the basal bone of the dorsal, which has winglike

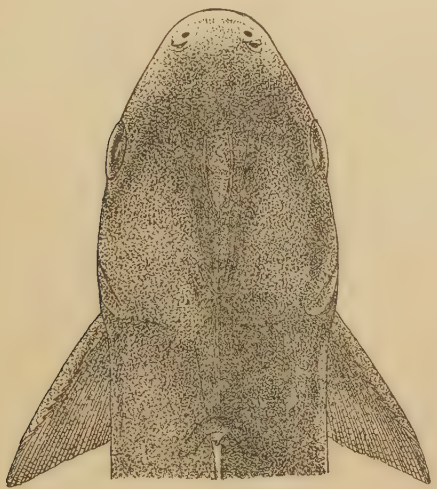


Fig. 108. *Arius argyropleuron* C. V. × $1^1/_4$.

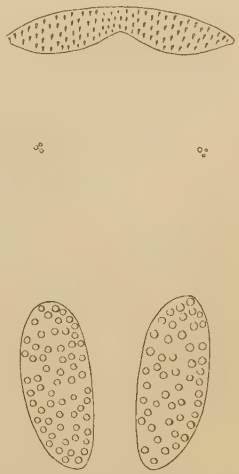


Fig. 109. *Arius argyropleuron* C.V. Teeth of upper jaw and palate × $2^1/_4$.

extremities. Median fontanel beginning at snout and ending before the occipital process, broadest in the middle. Dorsal profile sloping down in an almost straight line to the bluntly rounded conical, slightly prominent snout. Eyes with a free orbital margin, $4^1/_2$—7, situated about in the middle of the head, about 2 times in snout. The maxillary barbels extend on the pectorals or not quite so far, mandibulary barbels somewhat shorter, mental ones reaching to gillmembrane. Height of dorsal more than $^2/_3$ of head, its spine rather weak, equal to head without snout, slightly denticulated at the top of its frontborder and along the whole of its hindborder. Adipose fin small, its base

much less than that of the soft dorsal and about $4^1/_2$ times in its distance from that fin. Ventrals do not reach anal and are much shorter than pectorals, the length of which is about equal to head without snout, its flattened spine somewhat shorter and stronger than that of the dorsal. 7—8 stout, short gillrakers. Villiform teeth in an arcuate band in the jaws, granular teeth far back on the palate in 2 oval patches, the long axes of which converge hindward. Two small patches in front on the palate, reduced to a few small teeth or even wanting. Brownish above, whitish below. Outer half of fins dusky. Length 460 mm.

Nomen indig.: Ikan manjong (Malay. Batav.).

Habitat: Java (Batavia); Sumatra (Moara Kompeh, Bagan api api!); Borneo (rivers Kapuas and Baram, Balikpapan!, Sandakan).

In sea, estuaries and rivers.

4. Arius polystaphylodon Blkr.

Arius polystaphylodon Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 172.
Ariodes polystaphylodon Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri 1858, p. 90. — Atl. Ichth. II. 1862, p. 41.
Arius polystaphylodon Günther, Cat. Brit. Mus. V. 1864, p. 166.
Arius polystaphylodon Max Weber, Siboga-Exp. Fische, 1913, p. 28.

B. 6; D. I. 7; A. 15—17; P. I. 12.

Elongate, height 5, head about $3^1/_2$, higher than broad, its width $1^1/_2$ in its length. Hindpart of head rugous and somewhat granulate. Occipital process keeled, strongly elevated transversally, with rough and strong granulations, oblong; its margins irregularly convex in such a way that the hinder $^2/_3$ of the process forms a more or less triangular shield; the truncate hindborder touches the basal bone of the dorsal spine, which bone has winglike lateral extremities. The broad median fontanel begins near the extremity of the snout, bordered in its anterior half by 2 posteriorly divergent narrow bony crests, in its posterior half, which is narrowed to a mere slit, it is bordered by two broad, rounded crests, convergent to the base of the occipital process. Humeral process rather long, triangular, pointed and rugous. Dorsal profile sloping slightly down, with a convexity above the opercles, to the somewhat pointed, slightly prominent snout, the frontborder of which is rounded. Eye $6^1/_2$,

its greater part in the first half of the head, with a free orbital margin, more than 3 times in the interorbital space. Maxillary barbels $1^1/_2$ in head, relatively longer in small specimens, mandibulary ones $2^1/_5$ in head, mental ones still shorter. Height of dorsal at least as long as head without snout, its spine of equal length, granulate in front, serrated behind. Base of short adipose fin nearly half the length of that of the dorsal, about 7 times in its distance from it, situated above anal, which is not much longer than dorsal. Height of anal about equal to the length of the ventrals, which don't reach the anal.

Fig. 110. *Arius polystaphylodon* Blkr. × $^1/_2$.

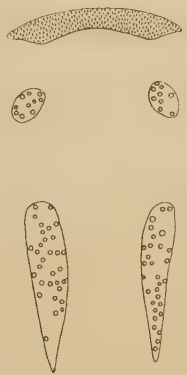


Fig. 111. *Arius polystaphylodon* Blkr. Teeth of upper jaw and palate $^1/_1$.

Pectorals equal to height of dorsal, their spine as long as or a little longer than the dorsal one, flattened, with the frontborder granular, the hindborder strongly serrated. Caudal deeply incised. Villiform teeth in the jaws, those on the palate obtusely conical in two small, oval, widely separate anterior patches; far behind them two long, narrow, oval patches, strongly narrowing behind, with the long axis parallel. 9 short, stiff gill-rakers, half as long as branchial filaments and shorter than half eye. Greyish brown above, silvery below, fins dusky. Length 340 mm.

Habitat: Java (Batavia); Sumatra (Moara Kompeh); Singapore; Celebes (Macassar!).

In sea, estuaries and rivers.

5. Arius leiotetocephalus Blkr.

Arius leiotetocephalus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 292.
Arius Meyenii Müller & Troschel, Horae Ichth. III. 1849, p. 9.
Ariodes leiocephalus Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 88. — Atl. Ichth. II. 1862, p. 40.
Arius liocephalus Günther, Cat. Brit. Mus. V. 1864, p. 165.

B. 6; D. I. 7; A. 15—17; P. I.12—I.13; V. 6.

Elongate, height $4^2/_3$—$5^1/_4$, head $3^1/_5$—$3^2/_3$, broader than high, its width about $1^1/_3$ in its length, nearly smooth above; occipital process granular, smooth in young specimens, ovate, $1^2/_5$ times longer than broad, mesially with a longitudinal elevation, touching the short and narrow basal bone of dorsal spine. A narrow median fontanel ending before the occipital process reaching to the snout. Dorsal profile sloping down to the conical rounded, slightly prominent snout. Humeral process triangular, smooth. Eye 7 (in a specimen of 315 mm.), with a free orbital margin, situated in the middle of the head, more than 3 times in the interorbital space. Maxillary barbels reaching hindborder of gillmembrane, mandibulary barbels not so far, mental ones still shorter. Dorsal fin about as high as body, its strong spine granulated anteriorly, posteriorly nearly smooth, $^2/_3$ or $^3/_4$ of the length of the head. Adipose fin small, its base about $^1/_2$ of that of the soft dorsal and more than 6 times in its distance from that fin, above the posterior half of the anal, the free border of which is concave. Ventrals extending to the origin of the anal, $^1/_3$ of length of pectorals, which are about as long as head without snout, their flattened spine serrated on both sides, about as long that of the dorsal. Caudal deeply incised, its lobes pointed. Teeth in the jaws in a villiform, arcuate band, on the palate granular, in 2 small, widely separate anterior patches and in two long, oval posterior ones, which posteriorly end in two narrow diverging points. 9 stiff, flattened short gillrakers. Brownish dark above, whitish below. Fins yellowish, dorsal with a dark point. Length to 470 mm.

Fig. 112. *Arius leiotetocephalus* Blkr. Teeth of upper jaw and palate $^1/_1$.

Nomen indig.: Ikan manjong tonggol.

Habitat: Java (Batavia, Surabaya); North of Rio straits!; Singapore; Celebes (Macassar). — Malacca.

In sea and estuaries.

6. Arius goniaspis Blkr.

Arius goniaspis Bleeker, Act. Soc. Indo-Neerl. III. 1858, Vischfauna Sumatra, p. 44.
Ariodes goniaspis Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 91. — Atl. Ichth. II. 1862, p. 42.
Arius goniaspis Günther, Cat. Brit. Mus. V. 1864, p. 166.

B. 6; D. I. 7; A. 16—17; P. I. 11; V. 6.

Elongate. Height about 5, head $3^3/_5$—$3^3/_4$, broader than high, its width $1^1/_4$—$1^1/_5$ in its length, depressed, crown convex, granulated above. Occipital process triangular, with the lateral margins straight, broader than long, subradially granulated, with its obtuse, emarginated hindborder touching the short, rugose basal bone of the dorsal spine. The long median fontanel extends nearly to the base of the occipital process. Dorsal profile ascending nearly in a straight line from the acute, convex snout, to the anterior part of the vertex, the posterior part being gibbous. Humeral process rather small, sharp, very rugose. Axillary pore conspicuous. Eye $3^2/_3$—4, superior, situated in the middle of the head, about twice in the interorbital space. Maxillary barbels reaching nearly to end of pectorals, mandibulary ones farther than base of pectorals, mental ones shorter. Dorsal slightly higher than body, about twice higher than long, its spine is of moderate strength, $1^1/_3$—$1^2/_3$ in head, with the hindborder slightly denticulated, anteriorly only near its tip. Adipose fin small, its base about 5 times in its distance from the dorsal. Anal acute, emarginate, longer than high, about twice longer than adipose fin. Pectorals $1^1/_3$—$1^1/_5$ in head, their spine nearly equal to that of the dorsal, but more slender, with similar denticulation. Ventrals about twice shorter than head. Caudal deeply incised, the superior of the acute lobes is the longer. Teeth in the jaws in a villiform band, slightly curved in the upper jaw and about 4 times longer than broad; in the lower jaw in a nearly semilunar band, slightly longer but more slender. Teeth on the palate conical, granular, arranged in four groups: a small ovate patch on each side of the vomer, and a flat elongate patch along

each palatine bone; the palatine patches divergent behind. Bluish green above, margaritaceous or silvery below. Fins yellowish, more or less dusky. Length of the two known specimens 100 and 113 mm. [After Bleeker and Günther, not seen by us].

Habitat: Sumatra (Priaman, Trussan, Benkulen).

In sea and estuaries.

7. Arius maculatus (Thunb.) [1]).

Silurus maculatus Thunberg, Kongl. Vetensk. Acad. Nya Handling. XIII. Stockholm, 1792, p. 31.
Arius gagoroïdes Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 168.
Arius Heckelii Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 169.
Arius pidada Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 169.
Arius angulatus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 170.
Arius chondropterygioides Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 170.
Arius viviparus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 171.
Arius borneensis Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 67.
Arius arius Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858. p. 73.
Arius pidada Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 74.
Pseudarius arius Bleeker, Atl. Ichth. II. 1862, p. 36.
Arius maculatus Günther, Cat. Brit. Mus. V. 1864, p. 166.
Arius maculatus Kner, Novara-Exp. Fische, 1865—1867, p. 311.

B. 5; D. I. 7; A. 19—22; P. I. 10—11; V. 6.

Elongate, height 4—5, head $3^2/_5$—4, somewhat broader than high, its width at least equal to head without snout. Head-shields granular and rugose, occipital process carinate, granulated, scarcely longer than broad and more or less triangular, the truncate hindborder touches the semicircular granulate basal bone of the dorsal spine. Median fontanel rather broad, beginning at the snout, narrowing behind and ending before occipital process. Humeral process triangular, granulated. Dorsal profile sloping down in a straight or slightly convex line to the bluntly rounded, slightly prominent snout. Eye $5^1/_2$ (in spec. of 330 mm.) with a free orbital margin, more than half length of snout and more than twice in the interorbital space. Maxillary barbels reaching on pectorals, in older specimens

1) We have no material to decide the question if *Pimelodus arius* H. B., *Arius arius* C. V. and *Arius Buchanani* Day from the Asiatic continent, belong to this species.

considerably shorter, mandibulary barbels to hindborder of gillmembrane, mental barbels much shorter. Height of dorsal longer than head without snout, osseous part of its spine rather strong, somewhat shorter than head without snout, with a filamentous prolongation, granulated in front, serrated behind. Base of adipose fin equal to soft part of dorsal, nearly 4 times in its distance from it; situated about above the middle of the anal, the height of which is less than the length of the ventrals, which extend at least to its origin. Pectorals about as long as postorbital part of head, osseous part of pectoral spine nearly of equal length, flattened and weakly serrated at both borders. Caudal deeply forked, with more or less rounded lobes, the upper one the longer. Villiform teeth in the jaws. Far back on the palate thick granular teeth in two separate, parallel, semioval patches. 14 conical, stiff, short gill-rakers, longest equal to pupil. Silvery, bluish brown above, belly and underside of head whitish. Fins yellowish, adipose fin with a large black spot.

Fig. 113. *Arius maculatus* (Thunb.) Teeth of upper jaw and palate $^1/_1$.

Length about 400 mm.

Nomen indig.: Ikan Manjong pidada, Ikan duri pidada (Malay. Batav.), Ikan lundu (Buluran).

Habitat: Java (Batavia!, Bantam, Krawang, Surabaya, Palabuan Batu, Pasuruan, Buluran!); Sumatra (Padang, Palembang!, Bagan api api!); Borneo (Banjermassin!, Prabukarta, Moratabas (Brit. Mus.)). — Philippines, Siam, China and Riu Kiu Islands.

In sea, estuaries and rivers.

8. **Arius microcephalus** Blkr.

Arius microcephalus Bleeker, Nat. Tijdschr. Ned. Ind. IX. 1855, p. 423. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 77.
Pseudarius microcephalus Bleeker, Atl. Ichth. II. 1862, p. 37.
Arius microcephalus Günther, Cat. Brit. Mus. V. 1864, p. 170.
Arius microcephalus Kner, Novara-Exp. Fische, 1865—1867, p. 312.
Arius microcephalus Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 173.

B. 5; D. I. 7; A. 19; P. I. 10; V. 8.

Elongate, height $4^1/_3$—$4^3/_4$, head 4—$4^1/_5$, broader than high, $1^1/_4$—$1^1/_5$ in length, granulated above. Rostrodorsal profile convex, occipital process subtriangular, scarcely longer than

broad at its base, much less than twice longer than broad at its posterior end, which is obtusely emarginate and touches the small granular basal bone of the dorsal spine. A long median lanceolate fontanel nearly reaching to the base of the occipital process. Eye $4^1/_2$ to more than 5, superior, with a free orbital margin, totally or nearly totally situated in the anterior half of the head, 2—$2^1/_3$ in the interorbital space, smaller than the convex, scarcely prominent snout. Humeral process of moderate strength, acute, rugosely reticulated. Axillary porus present. Maxillary barbels extending somewhat beyond the head, the intermaxillary ones not so far, the mental ones are still shorter. Dorsal acute, higher than the body, twice higher than long, its strong spine of same length or a little shorter, scarcely shorter than head, serrated along both edges. Adipose fin nearly as long as dorsal, removed 3 times its length from the dorsal, less than twice longer than high, obliquely convex. Anal acute, emarginate, much lower than body, about as long as high, much less than twice the length of the adipose fin. Pectorals scarcely shorter than the head, their strong spine somewhat shorter than the dorsal one, its hindborder conspicuously dentated, its frontborder weakly so. Ventrals about $1^1/_2$ times in length of head. Caudal deeply incised. The superior of the acute lobes is the longer. Small, acute teeth in the upper jaw in a slightly curved, broad band, 3 times as long as broad, its length nearly equal to that of the eye; in the lower jaw in a subsemilunar band not much longer than eye. Teeth on the palate rather large, molarlike, forming two separate, subovate patches, much longer than eye. Bluish green above, margaritaceous or silvery below. Fins yellowish, more or less dusky. Adipose fin with a large black spot. Length 213 mm. [After Bleeker and Günther, not seen by us].

Nomen indig.: Lundu (Serawak).

Habitat: Borneo (Banjermassin, Sarawak).

In rivers.

9. **Arius thalassinus** (Rüpp.) [Fig. 106, p. 273].

Bagrus thalassinus Rüppell, Neue Wirbeltiere, Fische 1835—1840, p. 75.
Arius nasutus Cuvier & Valenciennes, Hist. Nat. Poissons XV. 1840, p. 60.
Bagrus rhodonotus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 157.
Bagrus carchariorhynchos Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 291.

Netuma nasuta Bleeker, Ichth. Arch. Ind. Prodr. I Siluri 1858, p. 95.
Netuma thalassina Bleeker, Atl. Ichth. II. 1862, p. 28.
Arius thalassinus Günther, Cat. Brit. Mus. V. 1864, p. 139.
Arius thalassinus Kner, Novara-Exp. Fische, 1865—1867, p. 310.
Arius thalassinus Day, Fishes of India 4°. 1878—1888, p. 463.

B. 5; D. I. 7; A. 15—18; P. I. 11—13; V. 6.

Elongate. Height when young somewhat more than 4, when older to $5^2/_5$. Head $3^2/_5$ to more than 4, much broader than high, its crown granulated; occipital process triangular, with a median keel, longer than broad at its base, with straight borders, its truncated hindborder touching the basal bone of the first dorsal. Median fontanel shallow, narrowing posteriorly and ending at some distance from the occipital process. Humeral process triangular, strong, with waved rugae. Dorsal profile nearly straight. Snout obtuse when young, when adult pointed and projecting much beyond the lower jaw. Eye 3—6, with a free orbital margin, about twice in the snout, which is nearly equal to the postorbital part of the head. Maxillary barbels reaching to base of pectoral, mandibulary barbels $^1/_3$, mental barbel about $^1/_2$ shorter. Height of dorsal somewhat less than head, osseous part of its spine granulated in front, serrated behind, about equal to head without snout. Base of adipose fin much shorter than its height, equal to half length of dorsal, 6—7 times in its distance from lastnamed, situated above the middle of the anal, the lower border of which is emarginate and its height nearly equal to that of dorsal. Ventrals reaching on anal, their length equal to height of dorsal, slightly shorter than pectorals, the spine of which is flattened granulated in front, serrated behind, about as long as dorsal spine. Caudal deeply incised. Axillary pore present. Villiform teeth in upper jaw in a slightly arcuated broad band, in the lower jaw in a divided, somewhat narrower but more curved band. Teeth on the palate in two large, triangular, separate patches, the base of each triangle formed by two more or less quadrangular patches, the outher of which is the larger; behind them a much larger subtriangular patch. 9 rather stiff, cylindrical gillrakers, the longest about $^1/_3$ of the diameter of the eye. Reddish brown above,

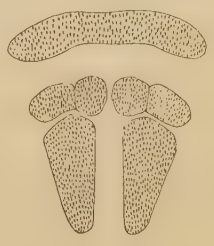


Fig. 114. *Arius thalassinus* (Rüpp.) Teeth of upper jaw and palate $^1/_1$.

greyish white below, fins more or less reddish hyaline. Distal part of dorsal, adipose fin, anal and caudal darkish as also the upper surface of the paired fins. Lenght to 1000 mm.

Nomen indig.: Ikan manjong utik, Manjong Karbo, Manjong tonggol (Malay. and Sundan.), Gunggut (Banjermassin).

Habitat: Java (Batavia!, Bantam, Tjiringin, Pasuruan, Besuki, Palabuan); Sumatra (Telokbetong, Benkulen, Padang, Tiku, Siboga); Nias; Singapore!; Bintang; Borneo (Banjermassin); Celebes (Macassar); Sumba!; Timor!; Rotti!; Mysore; New Guinea!. — Australia, New Caledonia, Philippines, Tonkin, westward to the Red Sea and coast of Zanzibar.

In sea.

Note: *Ariodes aeneus* described by *Sauvage* (Bull. Soc. Philomatique (7) VII. 1883, p. 160) from „Ile Raffles: Voyage de la Zélée" is perhaps a specimen of *Arius thalassinus*, in which the 2 anterior quadrangular patches on each side, which normally touch each other, are united. But it is impossible to decide this, as the only specimen is not to be found in the Paris Museum, as Dr. PELLEGRIN has the kindness to inform us.

10. Arius gagorides (C. V.).

? *Pimelodus sona* Hamilton Buchanan, Fishes Ganges, 1822, p. 172, 376.
Bagrus gagorides Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 441.
Bagrus trachipomus Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 443.
Arius gagorides Günther, Cat. Brit. Mus. V. 1864, p. 140.
Arius sona Day, Fishes of India, 4°. 1878—1888, p. 462.
Arius gagorides Duncker, Mitth. naturhist. Mus. Hamburg, XXI. 1904, p. 174.

B. 6; D. I. 7; A. 17; P. I. 12; V. 6.

Height rather more than 4, head $3^1/_2$, much broader than high, its greatest width being equal to the distance of the hinder nostril from the end of the opercle. Crown of head granulated, the granules being arranged in radiating series. Median fontanel wide, but it does not extend to the base of the occipital process, which is triangular, elevated into an obtuse ridge along its middle and rather broader than long; the basal bone of the dorsal spine is of moderate width, narrowest in the middle, each half slightly bent into an S-shaped form. Maxillary barbels reach to end of head or not so far, mandibular ones shorter. Dorsal spine strong, as long as head without snout, granulated in front and obtusely serrated be-

hind, not so high as the soft dorsal. Adipose fin equal to or somewhat shorter than dorsal. Pectoral spine stronger and usually slightly shorter than that of the dorsal, granulated exteriorly and serrated interiorly. Ventral fins much shorter than the pectorals, not extending on to the anal. Caudal deeply forked. Teeth on palate villiform, in 4 groups, the outer ones large, somewhat triangular and emarginate posteriorly, connected together anteriorly by the two small median groups. Colours: brownish above, bluish on the sides where it is glossed with gold, and dull white beneath. Fins with a bluish-black tinge. Young specimens are of a brownish colour, glossed above with purplish and yellow, the fins are nearly black. Length over 900 mm. [After Günther and Day; not seen by us].

Habitat: Singapore (Duncker).

Through the seas of India to Bombay, entering estuaries and tidal waters.

11. **Arius sagor** (Ham. Buch.)

Pimelodus sagor Hamilton Buchanan, Fish. Ganges 1822, p. 169.
Bagrus sondaicus Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 444.
Bagrus javensis Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 445.
Bagrus sagor Cuvier & Valenciennes, Hist. Nat. Poiss. XIV. 1839, p. 445.
Bagrus sondaicus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1237.
Hexanematichthys sundaicus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 127. — Atl. Ichth. II. 1862, p. 26.
Arius sagor Günther, Cat. Brit. Mus. V. 1864, p. 141.
Arius sagor Kner, Novara-Exp. Fische, 1865—1867, p. 310.
Arius sagor Day, Fishes of India, 4°. 1878—1888, p. 461.
Galeichthys sondaicus Fowler, Proc. Acad. Nat. Sc. Philadelphia (2) LVII, 1905, p. 462.
Arius sagor Seale, Philippine Journ. Science V. 1910, p. 266.

B. 5—7; D. I. 7; A. 18—19; P. I. 11; V. 6.

Elongate. Height $5^1/_4$—6, head $3^1/_2$—4, strongly depressed, much broader than high, its width a little less than its length. Bones of upper surface of head, and triangular humeral process strongly granulated, granules partly arranged in radiating or concentric lines; they extend even on the foremost part of the lateral line. Occipital process forming a subcircular plate, broader than long, with a median keel, touching the strongly granulated, very broad butterfly-shaped basal bone of dorsal spine, the form

of which is changing and its size increasing with age, as is also the case with the occipital process, which in youth is short and nearly triangular. Dorsal profile sloping down in a straight line to the broad, bluntly rounded, prominent snout. Eye $7^1/_2$ (in a specimen of 330 mm.) to more than 8 (specimen of 405 mm.), with a free orbital margin, about twice in snout, which goes about twice in postorbital part of head. Maxillary barbels reaching on middle of pectorals or farther, mandibulary barbels somewhat farther than base of pectorals, mental ones nearly to hindmargin of gillmembrane. Height of dorsal about equal to head without snout, the osseous part of its strong spine, which has a filamentous prolongation, is granulated at its frontborder, scarcely serrated behind and equal to postorbital part of head or somewhat longer. The base of adipose fin nearly equal to that of the dorsal. About 3 times in its distance from lastnamed, situated above the middle of the anal fin, the middle rays of which are the highest and about equal to the length of its base. Ventrals extending to the origin of anal or on anal.

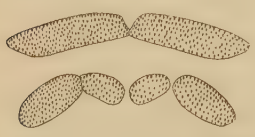


Fig. 115. *Arius sagor* (Ham. Buch.). Teeth of upper jaw and palate $^1/_1$.

Pectorals falciform, somewhat shorter than head, their strong spine obtusely serrated along both edges, much longer than dorsal spine. Axillary pore not very distinct. Villiform teeth in a narrow, slightly arcuated band in the jaws; on the palate in two pairs of posteriorly rounded patches; the outer patch is about twice as large as the inner one; both are confluent or separated by a very narrow interspace. 9 flattened, stiff gillrakers, the foremost the shortest, the longest much less than $^1/_2$ length of branchial filaments and $^2/_3$ of eye. Dark bluish brown above, whitish below. Base of fins reddish, their distal part more or less dark. Length about 450 mm.

Nomen indig.: Ikan Kedukan (Malay. Batav.), Kropah (Batav.), Ikan Babukan (Bagan api api), Ikan Brukan (Banjermassin), Ikan Bilukan (Sarawak).

Habitat: Java (Batavia!, Antjol!, Bantam, Surabaya!); Madura; Sumatra (Palembang, Bagan api api!, Deli!); Singapore!; Banka; Borneo (Singkawang, Sarawak, Baram-river, Balikpapan!, Kota baru!). — Pinang, Malacca, British India.

In sea, rivers and estuaries.

12. Arius stormi (Blkr.).

Cephalocassis Stormii Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 246.
Hemiarius Stormi Bleeker, Atl. Ichth. II. 1862, p. 29.
Arius stormii Günther, Cat. Brit. Mus. V. 1864, p. 162.

B. 6; D. I. 7; A. 16; P. I. 11; V. 6.

Elongate; height below dorsal spine $5^1/_2$, head about $3^1/_2$, depressed, broader than high, its width about $1^1/_3$ in its length. Headshields granular. Occipital process triangular, longer than broad, carinated, in old specimens mesially elevated, its side-borders straight or slightly concave, its truncate hindborder reaching the narrow crescentic basal bone of dorsal spine. Median fontanel somewhat triangular, its top ending at some distance of the occipital process; 2 rounded fontanels above the opercle. Dorsal profile sloping down in a nearly straight line to the somewhat pointed, strongly projecting snout. Eye 8—10, with a free orbital margin, about 3 times in the interorbital space and 3 times or more in the snout. Humeral process very narrow, originating from a broad base, its upper border concave. Maxillary barbels extend to the opercle, the mandibulary ones nearly to the hindborder of the gillmembrane, mental ones shorter. Soft dorsal equal to head from nostril, its very strong spine of equal length, granulated in front, serrated at both sides, the teeth looking upwards. Base of adipose fin longer than that of the dorsal, not yet twice in its distance from lastnamed, as long as the anal, the free margin of which is concave. Ventrals far distant from anal, shorter than pectorals, which are equal to head from middle of the eye, their strong flattened spine is shorter than the dorsal one, granulated in front, strongly serrated behind. Caudal deeply forked. Sharp teeth in an arcuate row in the jaws; those on the palate in four patches: two small median oval patches separated from each

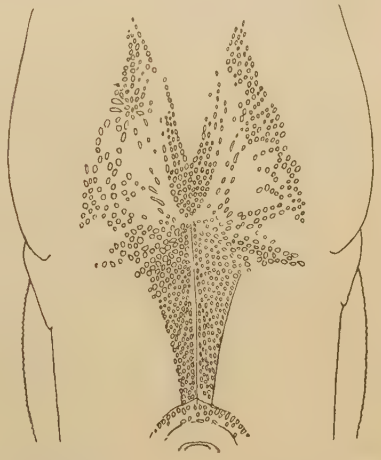


Fig. 116. *Arius stormi* (Blkr.). Granulated head shields × 3/4.

other by about their own length and contiguous with the lateral patches, which are about twice as broad as long, the whole forming one rather narrow, interrupted, arcuate band. About 10 stiff, flattened gillrakers, the longest about $^3/_4$ of branchial filaments and shorter than the eye. Brownish above, whitish below, fins yellowish, base of pectorals bluish. Length over 500 mm.

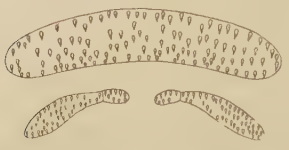


Fig. 117. *Arius stormi* (Blkr.) Teeth of upper jaw and palate $^1/_1$.

Nomen indig.: Ikan dukang (Palemb.).

Habitat: Sumatra (Palembang, Djambi!); Borneo (Banjermassin!).

In rivers.

13. Arius carinatus M. Web.

Arius carinatus Max Weber, Nova Guinea IX. livr. 4. 1913, p. 537.

B. 6; D. I. 7; A. 14—16; P. I. 10; V. 6.

Elongate; height under dorsal spine $4^3/_4$—$5^1/_2$, $4^1/_3$ to almost 5 before that spine. Head 4—$4^2/_3$, its width $1^1/_4$—$1^1/_5$ in its length, its profile ascends steeply, in full grown speci-

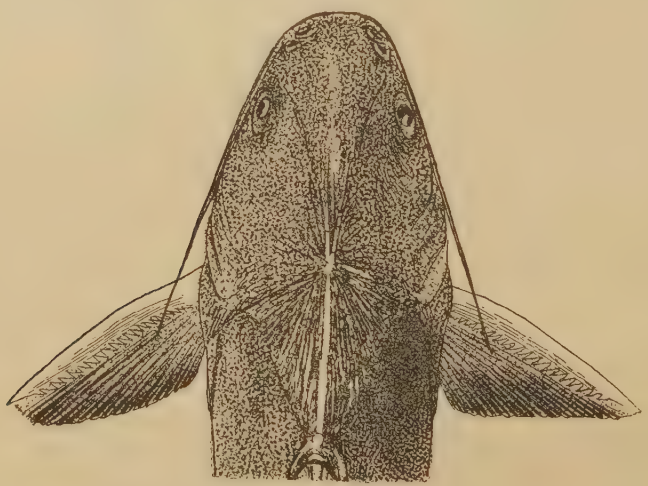


Fig. 118. *Arius carinatus* M. Web. nat. size.

mens nearly in a straight line from snout to dorsal. This line is the more convex in its posterior half, the younger the specimens are. Headshields rugose, when older granular. Occipital process scarcely longer than broad at its base, sharply

keeled in young specimens. Its posterior end broadly truncated. Median fontanel tapers acutely and reaches to crown of head. An oval fontanel above operculum. Humeral process granular, even as the broad, semicircular basal bone of dorsal spine. Eye 7—8, the snout 3 times or a little more, interorbital space nearly 3 times in head. Cleft of mouth with thick lips, more than $2^1/_2$ times in head. Maxillary barbels reaching to end of operculum or base of pectorals. Mandibulary barbels to hindborder of gillmembrane or not so far, mental barbels much shorter. Height of dorsal nearly equal to head without snout, its origin midway between ventrals and pectorals. The strong, flattened dorsal spine is equal to postorbital part of

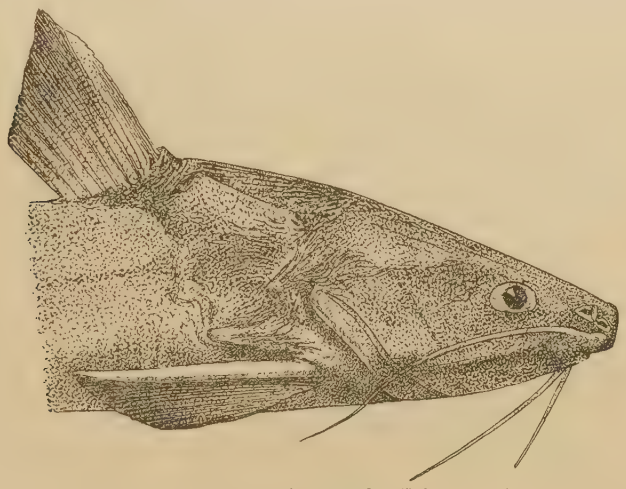


Fig. 119. *Arius carinatus* M. Web. nat. size.

head and its hindborder is conspicuously denticulated its frontborder only slightly so. Adipose fin originates before anal, its length is equal to postorbital part of head, is longer than the base of the dorsal and equals about $1^1/_2$ times its distance from the dorsal. Height of anal equal to postorbital part of head. Ventrals nearly as long as head without snout, nearly reaching to anal. Pectorals longer than head without snout, as long as their very strong flattened spine, the hindborder of which is serrated. Caudal deeply incised, the pointed lobes 3 times longer than the median rays. Axillary pore present. Pointed teeth in the upper jaw in two separate bands, nearly twice as broad as long, mesially rounded, laterally obliquely truncated, mandibulary bands narrower, slightly curved, tape-

ring outward. On the vomer few bluntly rounded teeth in two roundish groups, their own diameter apart, which distance increases when the groups are smaller. Similar teeth in two longish, oval groups on the palatines, nearly touching the vomerine groups. A median longitudinal keel on the palate. 10 stiff gillrakers, flattened at their base and separated by a broad, rather high membrane from about 13 stiff but low processes along the hindborder of the gillarch. Dark brown above, white below. Dorsal, adipose fin, caudal, distal part of anal and pectorals and basal part of ventrals dark, anal and ventrals sometimes hyaline. Length 425 mm.

Habitat: South New Guinea (Lorentz river!).

In fresh water.

14. Arius nudidens M. Web.

Arius nudidens Max Weber, Nova Guinea IX, livr. 4. 1913, p. 538.

B. 9; D. I. 7; A. 19; P. I. 11—12; V. 6.

Elongate; height under dorsal spine $5^3/_5$—6, head more than 3, its width $1^3/_4$—$1^4/_5$ in its length. In adults the dorsal profile gently sloping down in a straight line to the broad, flat, rounded snout, which goes $2^1/_2$ times or somewhat more in the head and projects so much before the lower jaw that the broad band of teeth in the upper jaw is completely exposed. Gape rounded, more than 2 times in head; lips strongly thickened at corner of mouth. Headshields corrugate, occipital process about $1^1/_2$ times longer than broad at base, sharply keeled in young ones, less so in adults, its sideborders convergent, rounded behind and touching the crescentic basal bone of dorsal spine. Median fontanel short and shallow. Rough humeral process short but broad. Eye with incomplete orbital ring, directed somewhat upwards, $9^1/_2$—$11^4/_5$ in length of head, $2^1/_2$—$4^1/_2$ in the slightly convex interorbital space. Maxillary barbels extending to base of pectorals, mandibulary ones on pectorals, mental ones about a half shorter. All barbels are ribbon-shaped, less so in young ones, where they are relatively shorter. Height of dorsal equal to head without snout, its flattened spine with serrated front and hindborders equal to postorbital part of head, one eye-diameter longer in young specimens. Base of well developed adipose fin much longer than that of dorsal, about 2 times in its distance from last-named. Anal with the hindborder concave, its greatest height

equal to length of pectorals, which are much less than $^1/_2$ length of head; their flattened spine, serrated behind, less than $^1/_2$ length of head and much shorter than that of dorsal. Ventrals rounded, not reaching anal and about $^2/_5$ of length of head. Caudal deeply forked. Axillary pore present. Villiform teeth in a broad, rounded band in the upper jaw, in two separate narrower bands in the mandibles. On the palate in 4

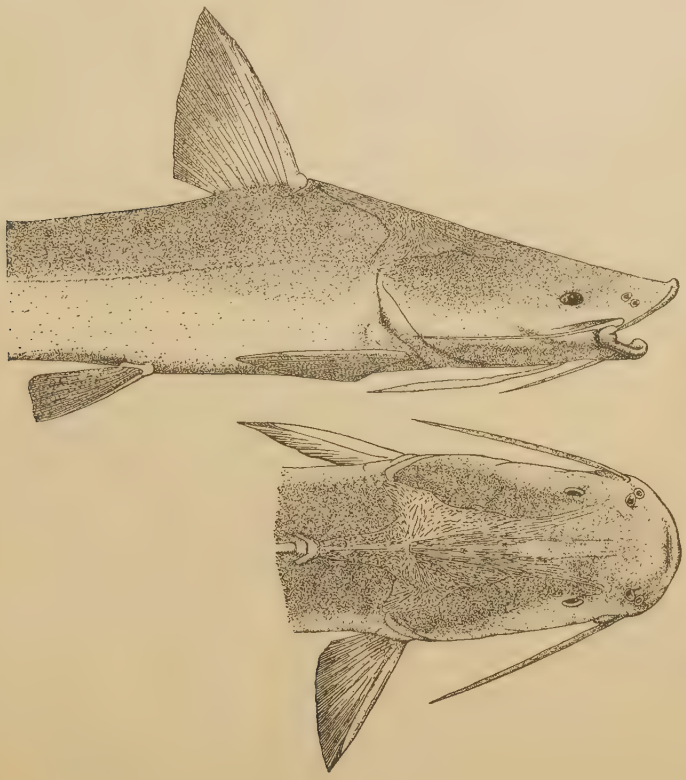


Fig. 120. *Arius nudidens* M. Web. × 0.3.

patches, the 2 rounded median ones half their diameter apart, touching the oval lateral ones, the long axes of which diverge posteriorly. 10 stiff, triangular, flattened gillrakers, the longest longer than branchial filaments. Whitish silvery, upperpart of head and body dark-bluish. Fins hyaline. Margin of dorsal, caudal and anterior part of anal blackish. Length 487 mm.

Habitat: South New Guinea (Lorentz river!).

In fresh water.

15. Arius spatula Rams. & Ogilb.

Arius spatula Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales, (2) I. 1886, p. 15.

D. 1.7; A. 20; V. 6; P. 1.9; C. 17.

„Length of head $3^{9}/_{10}$, of caudal fin $5^{1}/_{3}$, height of body $6^{2}/_{3}$ in the total length. Diameter of eye $6^{1}/_{4}$ in the length of head, $^{3}/_{7}$ of that of snout, and $^{2}/_{3}$ of the interorbital space. The height of the head is $^{5}/_{8}$ of its width, which is equal to its length behind the middle of the eye. Upper jaw so much the longer that the lower closes entirely inside the maxillary teeth; the width of the gape of the mouth is $^{3}/_{7}$ of the length of the head. Median longitudinal groove shallow and indistinct; occipital process narrow, the width of its base being one half of its length, the sides are convergent behind to immediately in front of the basal bone of the dorsal fin round which they bend outwards; posterior part of the head granulated. The maxillary barbel reaches to the lower angle of the opercle, the external mandibular to the base of the pectoral. A broad band of obtusely conical villiform teeth on the jaws; the vomerine teeth form two small square patches, about their own length apart, and contiguous with the divergent palatine bands, which are thrice as long as broad. The dorsal fin is higher than the body, the spine as long as the head excluding the snout; it is roughened on its lower part anteriorly, weakly serrated on its upper half and posteriorly; the length of the base of the adipose dorsal is $^{1}/_{3}$ more than that of the rayed fin; the pectoral spine is shorter than that of the dorsal, and is weakly serrated on both sides; the ventrals do not reach the anal fin. Caudal deeply forked. Colors, brown above, yellowish below; an oblong white spot on the middle of the occiput. Length of the specimen described 317 mm." [After Ramsay and Ogilby; not seen by us].

Habitat: South New Guinea (Strickland River).

16. Arius latirostris Macleay.

Arius latirostris Macleay, Proc. Linn. Soc. N. S. Wales VIII. 1884, p. 277.
Arius latirostris Max Weber, Nova Guinea IX. livr. 4. 1913, p. 540.

D. I. 7; A. 5. 15; P. I. 10.

Elongate, height $4^{3}/_{10}$, head $3^{1}/_{5}$, very broad and depressed in front, not much broader than long. Headshields slightly rugose and granular in some places, even as the occipital

process, which is about 3 times longer than broad, with the borders nearly parallel, its truncate hindborder touching the broad, granular, somewhat horseshoe-shaped basal bone of the dorsal spine. Humeral process triangular, rather short. Dorsal profile sloping down in a straight line to the very broad, rounded snout, the gape of which is $1^3/_4$ the length of the head. Eye 11, with a free orbital margin, situated in the anterior $^1/_3$ of the head, about 6 times in the flat interorbital space, $2^1/_2$ in snout. Barbels short, the length of the maxillary ones in our specimen (650 mm.) equal to the distance between the front-border of snout and the hindborder of the eye; mandibulary ones about of equal length. Height of dorsal $1^3/_5$ in length of head, its spine $1^3/_4$ in same length, rugous in front, dentated behind. Base of adipose fin nearly equal to that of the dorsal, nearly 4 times in its distance from that fin, above hinderhalf of anal, the free border of which is slightly concave. Ventrals touching the anal, shorter than the pectorals, about as long as the dorsal; the pectoral spine equal to $^1/_2$ length of head, rough in front, nearly smooth behind. Caudal deeply forked, lobes pointed. Villiform teeth in the upper jaw in a rather broad band, the two halves of which meet at an obtuse angle; the two mandibulary bands are curved, those on the palate in a broad, curved band, consisting of two median square patches, separated by a narrow interspace, laterally contiguous with the lateral patches, which are much broader than long. 12 stiff, flattened, triangular gillrakers, about half as long as the eye. Dark brown above, white below, dorsal, adipose fin, anal and caudal darkish. Ventrals and pectorals yellowish. Pectorals with a dark spot on inner half of upper surface. Length about 650 mm.

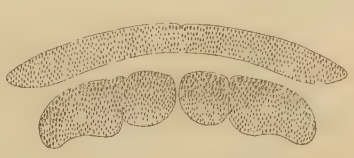


Fig. 121. *Arius latirostris* Macl. Teeth of upper jaw and palate, about $^1/_2$.

Habitat: South New Guinea (Goldie river, Lorentz river!). In fresh water.

17. Arius stirlingi Ogilby.

Arius stirlingi Douglas Ogilby, Proc. Linn. Soc. N. S. Wales, XXIII. 1898, p. 281.

Nemapteryx stirlingi Douglas Ogilby, Ann. Queensl. Mus. N°. 9, 1908, p. 10.

Arius stirlingi Max Weber, Nova Guinea, IX. livr. 4. 1913, p. 540.

D. I. 7; A. 23; P. I. 10; V. 6.

Elongate. Height below dorsal spine $4^3/_5$—5, head $3^2/_5$, width of head $1^3/_{10}$ in its length, its dorsal profile sloping down in a straight line to the rounded, flattened, prominent snout which goes more than $2^1/_2$ times in head. Upper jaw projecting in such a way, that the larger part of the band of its teeth is not covered by the lower jaw. Mouth slightly rounded, nearly equal to postorbital part of head. Lips thickened where they meet. Headshield posteriorly striped and roughly but scarcely granulated; occipital process keeled, granulated, about twice as long as broad in its middle, its borders slightly concave and converging, hindborder deeply emarginate, touching the narrow crescentic basal bone of dorsal spine. Median fontanel shallow but broad, anteriorly bordered by two parallel ridges, posteriorly by two converging ridges, which

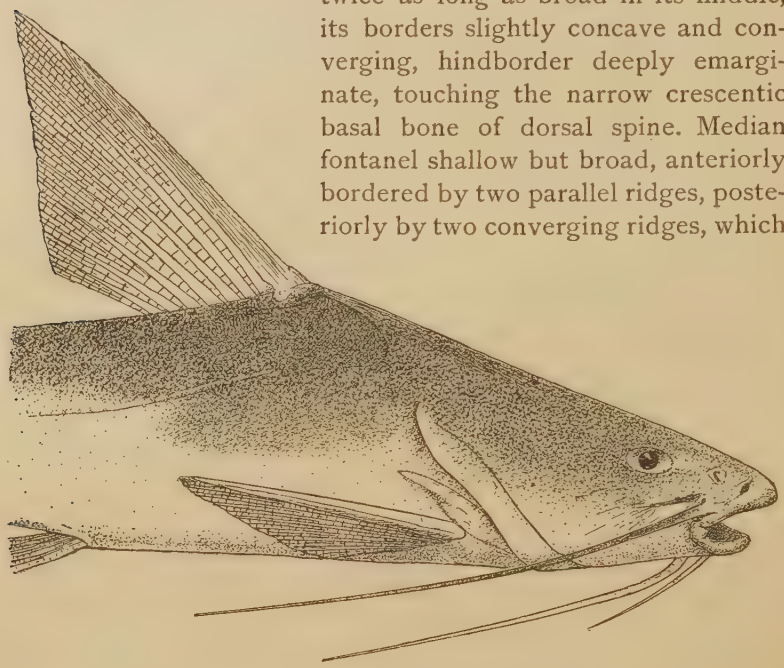


Fig. 122. *Arius stirlingi* Ogilby. About nat. size.

are continued at their meeting point in the median crest of the occipital process. Humeral process a short but sharply pointed, smooth triangle. Eye $7^3/_5$—$8^1/_5$, with the orbital margin quite incompletetely free, slightly directed upwards, about thrice in the slightly concave interorbital space, which goes $2^1/_2$—$2^4/_5$ in head. Maxillary barbels extending on to ventrals or at least to end of pectorals, mandibulary barbels to middle of pectorals, mental barbels to posterior border of

gillmembrane. Height of dorsal, without the filamentous prolongation of the first ray which may occur, nearly equal to head; upper border of dorsal strongly declivous. Dorsal spine flat, serrated posteriorly, anteriorly only at its top; equal to head from anterior nostril. Base of adipose fin much shorter than that of dorsal, more than thrice in the distance between both. Anal emarginate, its height somewhat more than postorbital part of head. Caudal deeply forked, its median rays nearly $^1/_4$ of its pointed lobes. Ventrals very broad, rounded, extending on anal. Pectorals slightly longer than head without snout, their flattened spine similar to that of the dorsal but con-

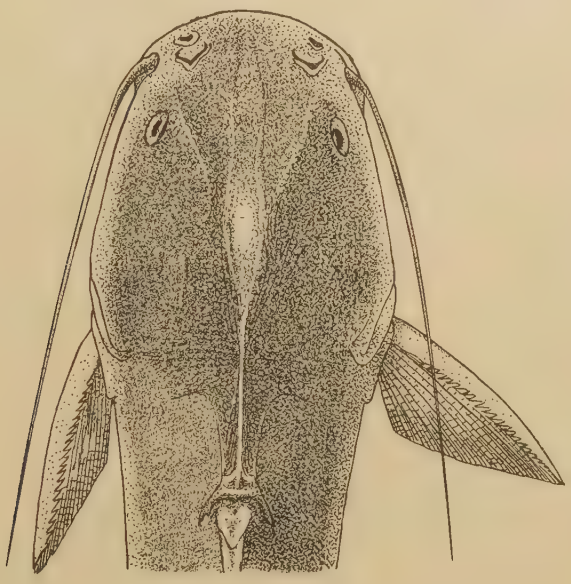


Fig. 123. *Arius stirlingi* Ogilby. About nat. size.

siderably shorter. Axillary pore minute. Villiform teeth in upper jaw in a slightly arcuate, broad band. In the lower jaw in a divided, somewhat narrower band. Vomerine teeth in two oval patches, separated by an interspace of half their width. Palatine patches narrowly separated from and nearly twice as wide as vomerine patches, they are ovate with the axes directed obliquely antero-posteriorly. 11 stiff, flattened, triangular gillrakers, ventrally decreasing rapidly in size, the longest shorter than the branchial filaments. Dorsal surface dark reddish

brown, ventral surface white, as also the upperlip; maxillary barbels bluish black, mandibulary barbels superiorly of same colour, inferiorly white as also the mental ones. Fins reddish, their border blackish, especially that of the caudal. Lenght 270 mm.

Habitat: South New Guinea (Lorentz river!). — North and North East Australia.

In rivers and estuaries.

18. Arius danielsi T. Regan.

Arius (*Hemiarius*) *Danielsi* Tate Regan, Ann. Mag. Nat. Hist. (8), I. 1908, p. 154.
Arius Danielsi Max Weber, Nova Guinea IX, livr. 4. 1913, p. 542.

B. 6; D. I. 7; A. 23—26; P. I. 9; V. 6.

Elongate; height $4^3/_4$ to nearly $5^1/_5$, head $3^1/_5$—$3^1/_2$, its width $1^1/_3$—$1^1/_2$ in its length. Dorsal profile sloping down from dorsal nearly in a straight line to the flat, rounded snout which projects so far before the lower jaw, that the maxillary teeth remain uncovered. Lips thin, forming a fold at the corner of the rounded mouth, which goes nearly twice in the head. Eye $5^2/_5$—$8^1/_2$, 2—3 in snout, situated laterally behind and partly above the fold of the

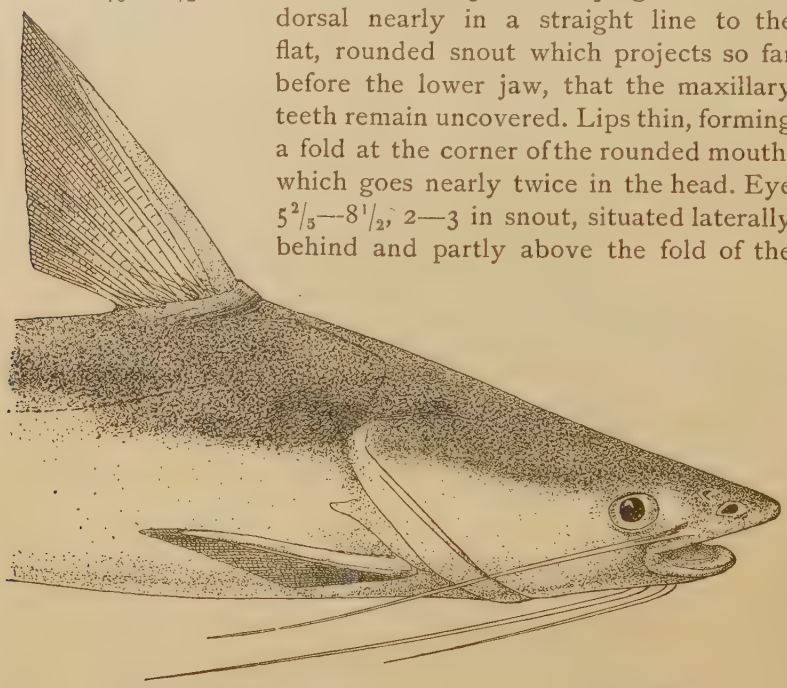


Fig. 124. *Arius danielsi* Regan. × 5/6.

corner of the mouth, more than 4 times in the convexity of the interorbital space. Free orbital margin wanting above. Posterior surface of head granulated, occipital process with median keel, $1^1/_2$ times as long as broad, extending to the crescentic basal

bone of the dorsal spine. Its sideborders slightly converging and nearly straight or very slightly convex. Maxillary and mandibulary barbels extending to the extremity of the pectorals or not so far, mental barbels nearly $^1/_3$ shorter. Dorsal situated midway between pectorals and ventrals, its height equal to head without snout, its spine scarcely longer than postorbital part of head, the posterior border with strong and long, the upper end of anterior border with weak serrations. Adipose fin small, above anal, its base much shorter than that of the dorsal, about 5 times in the distance between both fins; when young

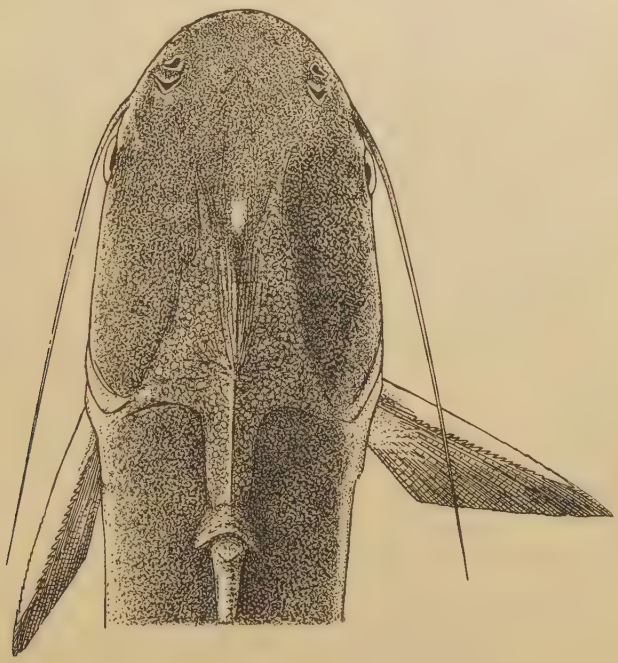


Fig. 125. *Arius danielsi* Regan. × $^5/_6$.

much less. Height of anal more than twice in head. Ventrals $2^1/_2$ in head, extending on anal. Pectorals about equal to head without snout, their spine somewhat stronger than and as long as that of the dorsal, strongly serrated at the inner side, feebly denticulated at the outer side. Caudal forked, its pointed lobes more than thrice longer than the median rays. Villiform teeth in the upper jaw in a broad, strongly curved band, the two bands in the lower jaw much narrower.

Teeth on the vomer in two slightly separated, oval patches, contiguous with the palatine patches, which are rather more than twice as broad as antero-posteriorly long. 16 stiff, triangular gillrakers, ventrally decreasing much in length, the longest about equal to branchial filaments. Brown-grey above, silvery below and on the sides. Fins yellowish, margin of caudal dark. Length over 260 mm.

Habitat: South New Guinea (Fly river!; Lorentz river!). In tidal part of rivers.

19. Arius acrocephalus M. Web.

Arius acrocephalus Max Weber, Nova Guinea IX. livr. 4. 1913, p. 543.

B. 6; D. 1. 7; A. 17; P. 1. 10; V. 6.

Elongate. Height below dorsal spine $4^1/_2$, head about $3^1/_3$, its width about $1^1/_2$ times in its length. Dorsal profile sloping steeply to the snout in a straight line, with exception of a feeble convexity above the opercles. Headshields with feeble, granulated lines. Occipital process with slightly convergent straight sideborders, its truncate hindborder touches the semicircular basal bone of the dorsal spine, its width at base $1^1/_3$ in its length. Rhombic median fontanel elongate, reaches to the last $^1/_4$ of head. The broad, short humeral process with reticulate ridges. Eye $6–6^1/_2$, almost 3 times in the interorbital space, more than 2 times in the prominent snout, which is $^1/_3$ of length of head and which is shorter than the curved gape. Lips thin, only prominent at the corner of the mouth. Maxillary barbels do not reach base of pectorals, mandibulary ones to hindborder of the gillmembrane, mental ones $^1/_3$ shorter. Height of dorsal more than head without snout, its spine scarcely longer than postorbital part of head,

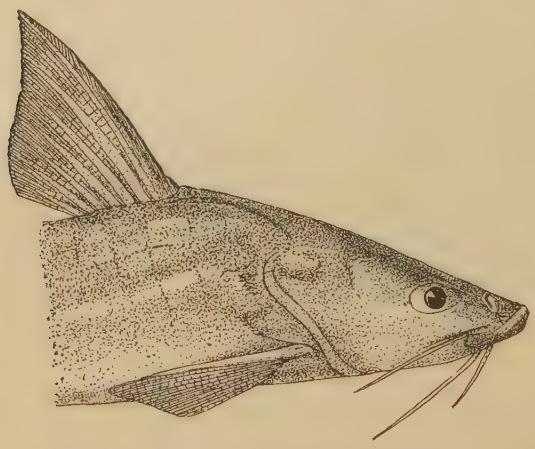


Fig. 126. *Arius acrocephalus* M. Web. $^1/_1$.

granulated at its front and hind-border. Base of adipose fin a little less than that of dorsal, $2^1/_2$ to 3 times (in adult specimens) in its distance from that fin. Height of anal equal to postorbital part of head, ventrals scarcely shorter and not or scarcely reaching anal. Pectorals pointed, as long as the head without snout, their flattened spine one eyediameter shorter, its frontborder feebly and its hindborder strongly serrated or granulated, about as long as that of the dorsal. Caudal deeply forked. Axillary pore present. Villiform teeth in an arcuate band in the jaws, in 4 patches on the palate, the two oval median ones their own diameter apart and separated from the two outer lateral ones, which are slightly curved and 3 times as broad as long. 9 stiff, broadened and pointed gillrakers, decreasing in size anteriorly, the longest equal to length of branchial filaments. Silvery, upper surface of head and body bluish grey, dorsal and caudal with black edgings, sometimes the entire lobes of lastnamed fin blackish. Length about 240 mm.

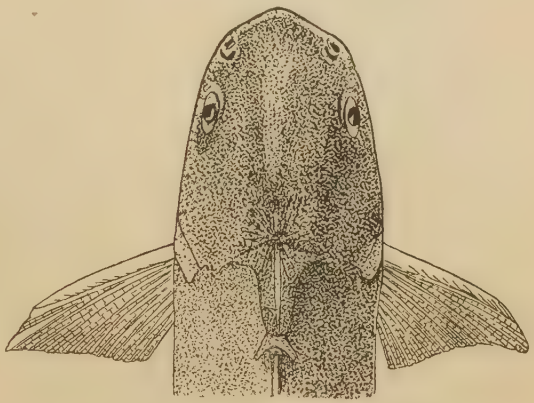


Fig. 127. *Arius acrocephalus* M. Web. $^1/_1$.

Habitat: South New Guinea (Lorentz river!).

In tidal reach of river and above it.

20. **Arius leptaspis** (Blkr.).

Hexanematichthys leptaspis Bleeker, Atl. Ichth. II. 1862, p. 27.
Arius leptaspis Max Weber, Nova Guinea V. livr. 2. 1908, p. 227.
Arius leptaspis Max Weber, Nova Guinea IX. livr. 4. 1913, p. 544.

B. 6; D. I. 7: A. 4. 15; P. I. 9; V. 6.

Elongate; height under the dorsal spine somewhat more than 5. Head about $3^1/_2$, much broader than high, its width about $^1/_6$ shorter than head. Headshields corrugate; occipital process triangular, longer than broad at its base, its rather broad, truncate hindborder touching the narrow, crescentic basal bone, mesially with a longitudinal, blunt elevation.

Dorsal profile sloping down with a slight concavity on the occiput to the broad, rounded, flattened snout. Eye in the anterior half of the head, with a free orbital margin, about 6 (in specimen of 345 mm.); about 4 times in the slightly convex interorbital space. Humeral process a long, narrow triangle, sharply pointed, rugous. Maxillary barbels extending to middle of pectorals, mandibulary barbels not quite so far, mental ones to the hind-border of the gillmembrane. Height of dorsal equal to head without snout, its strong spine equal to post-orbital part [1]), anteriorly rugous, posteriorly serrated. Base of adipose fin somewhat shorter than that of dorsal, nearly 4 times in its distance from that fin, situated above middle of anal, the free border of which is concave and the height of which is nearly $^1/_2$ of head. Ventrals reach anal, much shorter than pectorals, which are as long as head without snout, their strong flattened spine is anteriorly scarcely, posteriorly strongly serrated, as long as head without snout [1]). Caudal deeply forked, lobes pointed, the upper one the longer. Villiform teeth in the jaws in an arcuate band; on the palate in 4 distant patches, forming a rather broad, arcuate band, the two median ones oval, separated by a narrow interspace, half broader than long, contiguous with the somewhat obliquely placed lateral ones, which are oval and twice broader than long. 12 flattened

Fig. 128. *Arius leptaspis* (Blkr.) × $^1/_2$.

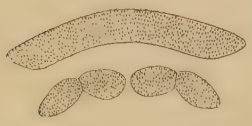


Fig. 129. *Arius leptaspis* (Blkr.). Teeth of upper jaw and palate $^1/_1$.

1) This is the case in specimens above 325 mm. In specimens of 295 mm. and less, we find the dorsal spine equal to the head without snout and the pectoral spine equal to head from posterior nostril. (cf. M. Weber l. c.).

stiff gillrakers, $^3/_4$ of branchial filaments, about half eye. Length about 370 mm.

Habitat: New Guinea (Lorentz river!, Moaif river! Kaiserin-Augusta river!); Aru-islands!

In rivers.

21. Arius melanochir Blkr.

Arius melanochir Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 590.
Cephalocassis melanochir Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 103. — Atl. Ichth. II. 1862, p. 30.
Arius melanochir Günther, Cat. Brit. Mus. V. 1864, p. 161.

B. 6; D. I. 7; A. 17—19; P. I. 11—12; V. 6.

Elongate; height (measured below dorsal spine) $5^1/_4$, head 4 or more than 4, the height and the width of the head are subequal and about equal to its length without snout. Bones on the crown of the head rugous; occipital process narrow, much longer than the width of its base, its sideborders nearly parallel, its truncate hindborder touches the narrow basal bone of the dorsal spine. Dilated, heartshaped median fontanel on the occiput, on both sides of which a lateral oval fontanel. Eye 6—8, with an incomplete superficial free orbital margin, situated in the anterior half of the head, more than twice in the length of the snout and in the interorbital space. Dorsal profile slightly convex, sloping to the conical, bluntly rounded, prominent snout. Maxillary barbels extending on pectorals, the mandibulary ones to the base of the pectorals, the mental ones to the hindborder of the gillmembrane. Height of dorsal as long as head or somewhat shorter, its strong, flattened spine somewhat shorter, its frontborder granulated and serrated at its top, the hindborder with the dentations partly directed upward. Base of adipose fin much longer than that of anal and dorsal, less than $1^1/_2$ in its distance from it. Its origin far before origin of anal. Height of concave anal equal to the ventrals, which don't extend to its origin. Pectorals scarcely shorter than head, with a very strong, flattened spine, serrated at both sides, which is slightly shorter than that of the dorsal. Small, conical teeth in the jaws and in two widely separate, oblique, posteriorly diverging, more or less elliptic patches on

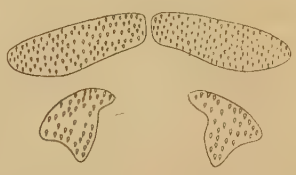


Fig. 130. *Arius melanochir* Blkr. Teeth of upper jaw and palate × 2.

the palate, which are shorter than the eye. 9 stiff, somewhat flattened gillrakers, shorter than branchial filaments and slightly longer than half eye. Darkish brown above, white below. Fins yellowish, blackish in the middle, adipose fin without black spot. Length about 300 mm.

Habitat: Sumatra (Palembang, Djambi!); Borneo (river Kapuas).

In rivers.

22. Arius leptonotacanthus Blkr.

Arius leptonotacanthus Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Ichth. Madura, p. 11.
Cephalocassis leptonotacanthus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 105.
Arius leptonotacanthus Bleeker, Atl. Ichth. II. 1862, p. 32.

B. 6; D. I. 7; A. 20—21; P. I. 11; V. 5.

Elongate. Height about $4^2/_5$. Head 3, broader than high, its greatest width being contained $1^2/_5$ in its length. Head scattered with very small granulations. The long, broad median fontanel reaches to base of occipital process, which is triangular, shorter than broad at its base, elevated along the middle, its broad truncated or emarginated hindborder reaching the small, smooth basal bone of the dorsal spine. Eye lateral, about $5^2/_3$, with a free orbital margin, about three times in the interorbital space, situated in the posterior part of the anterior half of the head, not twice as long as the depressed, convex snout. Humeral process of moderate length, rugous. Axillary pore present. Maxillary barbels extending to base of pectorals, mandibulary ones to branchial opening, the mental ones shorter. Dorsal scarcely as high as body, twice higher than long, its rather slender spine $1^1/_2$ times in head, with the hindborder with strong spines, directed downward, the top of its frontborder slightly serrated. Adipose fin much shorter than base of dorsal, its base more than 3 times in its distance from lastnamed. Anal rounded anteriorly, slightly emarginated, about twice longer than adipose fin, much longer than high. Pectorals nearly $1^1/_2$ times in head, their spine stronger than the dorsal one, but slightly shorter, strongly denticulated behind, the top of its frontborder serrated. Ventrals acutely rounded, shorter than pectorals. Caudal deeply incised, with acute lobes. Small, sharp teeth in curved bands in the jaws. The teeth on the palate are villiform, and form two

widely separate, elongate, pearshaped patches, slightly bent, narrow, and not much shorter than the eye, somewhat convergent posteriorly. Olivaceous above, whitish or silvery below. Fins yellowish, more or less dusky. Length of only specimen known 211 mm. [After Bleeker and Günther, not seen by us].

Nomen indig: Keteng (Madura).

Habitat: Madura sea near Surabaya.

In sea.

23. Arius froggatti Rams. & Ogilb.

Arius froggatti Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales (2) I. 1886, p. 14.
Cinetodus froggatti I. Douglas Ogilby, Proc. Linn. Soc. N. S. Wales, 1898, p. 32.

D. I. 7; A. 19; P. I. 11; V. 6.

Height $5^1/_3$ in the total length. Head somewhat depressed, wider than deep, $4^2/_3$ in the total, its upper profile straight, gradually rising to the origin of the dorsal fin. Mouth small and crescentic, the width of its gape $3^1/_4$ in the length of the head; upper jaw slightly projecting; lips thin, without posterior lobe. Eyes small and lateral, their diameter $^1/_5$ of the length of the head, $^5/_8$ of that of the snout, which is obtuse and equal to the breadth of the bony interorbital space. Occipital process triangular, nearly as broad as long, with a crest. Posterior part of head densely granulated, as also are the edges of the occipital fontanel, which is narrower and much shorter than the interorbital fontanel; supraorbital fontanel present; otic fonticle small and circular. Humeral process granular. The maxillary barbel extends backwards to the base of the pectoral fin, the mandibulary one not quite so far. Dorsal fin inserted above the interspace between the pectorals and ventrals; its height equal to height of body, its spine as long as the head behind the posterior nostril; it is strongly granulated in front for two thirds of its height; the remaining third and the entire back being weakely serrated. Adipose fin opposite to anal, the length of its base equal to that of the rayed fin. Pectoral spines very strong, considerably longer than the dorsal spine, slightly ruffened on the outside and strongly denticulated on the inside. They almost reach to the ventrals, which on their part just touch the anal fin. Caudal $4^2/_3$ in the total length, deeply forked, the upper lobe the longer. Jaws with broad bands of small, conical, acute teeth;

palatines anteriorly with a patch of similar teeth implanted upon a movable cushion; no vomerine nor posterior palatine patches. Gillrakers short, stout, few in number. Axillary pore present. Steel-blue above, silvery below, faint white spot on the occiput and another in the posterior angle of the base of the rayed dorsal. Length of single known specimen 294 mm. [After Ramsay and Ogilby; not seen by us].

Habitat: South New Guinea (Strickland river).

24. **Arius truncatus** C. V.

Arius truncatus Cuvier & Valenciennes, Hist. Nat. Poissons XV. 1840, p. 64.
Arius truncatus Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1238.
Cephalocassis truncatus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 108.
Arius truncatus Bleeker, Atl. Ichthyol. II. 1862, p. 33.
Arius truncatus Günther, Cat. Brit. Mus. V. 1864, p. 158.

B. 6; D. I. 7; A. 22—25; P. I. 9; V. 6.

Elongate. Height 5—6; head $3^3/_5$—$3^3/_4$, depressed, its greatest depth $^1/_2$ of its length and $^2/_3$ of its width. Its crown granular. Occipital process about twice as long as broad, its side borders nearly parallel, touching with its truncate hindborder the small, crescent-shaped basal bone of dorsal spine. Median fontanel narrow and long. Dorsal profile very slightly convex, sloping down to the flattened, obtusely rounded, slightly prominent snout. Eye 6—10, with a free orbital margin, which forms a broad, transparent upper eyelid, situated in the second $^1/_4$ of the head, nearly thrice in the convex interorbital space. Maxillary barbels extending scarcely to the hindborder of the operculum, the mandibulary and mental ones to the hindborder of the gillmembrane. Height of dorsal longer than head without snout, osseous part of its spine strong, $^4/_5$ of length of head, serrated along both edges. Adipose fin elevated, its base equal to that of dorsal, the distance from which is about 3 times its length. The adipose fin is situated above the middle of the anal, which is emarginate and the height of which is about equal to postorbital part of head. Ventrals reaching to anal, somewhat shorter than pectorals, the spine of which is shorter than the dorsal one, serrated along both edges. Caudal short, forked, with the lobes obtusely rounded.

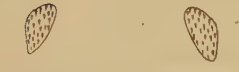


Fig. 131. *Arius truncatus* C. V. Teeth of upper jaw and palate × $4^1/_4$.

Villiform teeth in a narrow, slightly arcuate band in the jaws, those on the palate are more conical, in two widely separate, small, oval patches, the long axes of which meet anteriorly in an acute angle. 7 distant, very short gillrakers. Dark bluish above, whitish below, fins whitish, dorsal and caudal with a dark border. Length 330 mm.

Nomen indig.: Gutgut (Djambi).

Habitat: Java; Sumatra (Palembang, Djambi!); Borneo (Pamangkat, Sinkawang). — Pinang, Malacca, Siam.

In rivers and estuaries.

25. Arius macronotacanthus Blkr.

Arius macronotacanthus Bleeker, Nat. & Geneesk. Arch. Ned. III (2). 1846, p. 159. — Verh. Bat. Gen. XXII. 1847, Silur. batav. p. 32.
Arius arius Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1240. (fide Günther).
Cephalocassis macronotacanthus Bleeker, Ichth. Arch. Ind. Prodr. I. 1858, p. 106.
Arius macronotacanthus Bleeker, Atl. Ichth. II. 1862, p. 32.
Arius macronotacanthus Günther, Cat. Brit. Mus. V. 1864, p. 169.
Arius macronotacanthus Volz, Zool. Jahrb. Abth. Syst. XIX. 1903, p. 389.

B. 6; D. I. 7; A. 19; P. I. 9; V. 6.

Height $4^1/_2$—$4^3/_4$; head about $3^1/_2$, nearly as high as broad, its greatest width about equal to head without snout, its bony shields finely granulated and rugous. Occipital process with a median keel, triangular, about as long as broad, its sideborders straight, its truncate hindborder touching the narrow, semicircular basal bone of the dorsal spine. The narrow median fontanel begins above the hindborder of the eyes and reaches nearly to the occipital crest. Dorsal profile with a convexity at the occipital process, very gently sloping down to the rounded, slightly prominent snout. Eye $5^1/_2$ (in specimens of 230 mm.), with a free orbital margin, nearly twice in snout and less than thrice in the interorbital space. Maxillary barbels

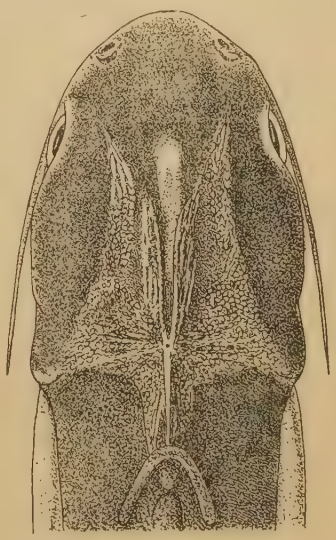


Fig. 132.
Arius macronotacanthus Blkr. × $^5/_6$.

extend to the end of the rough humeral process or somewhat farther, mandibulary barbels to base of pectorals, mental ones do not reach hindborder of gillmembrane. Height of dorsal shorter than head, its osseous spine with a filament; it is very strong, especially at its base, granulated in front, slightly serrated behind and as long as head or somewhat shorter. Base of adipose fin equal to that of soft dorsal and thrice in its distance from lastnamed, above anterior half of anal, which is concave. Ventrals shorter than pectorals, which are about as long as head without snout, the osseous part of the strong flattened spine is equal to head without snout, granular in front, serrated behind. Small teeth in an arcuate band in the jaws, on the palate finely granular, in two elliptic widely separate patches, about as long as the eye, diverging posteriorly. 9 cylindrical gillrakers, decreasing rapidly in size, the longest conspicuously shorter than $^1/_2$ of branchial filaments, about $^1/_3$ of eye. Caudal with pointed lobes, the superior one the longer, nearly 6 times in the total length. Dark bluish above, whitish below, adipose fin with a large black spot. Length about 300 mm.

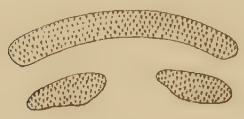


Fig. 133. *Arius macronotacanthus* Blkr. Teeth of upper jaw und palate × 2.

Nomen indig.: Ikan Manjong pidada (Batav.).

Habitat: Java (Batavia); Sumatra (Padang, Banjuasin, Priaman, Bagan api api!); Singapore. — Pinang.

In sea and rivers.

Note: We draw attention to *Arius bleekeri* described by Dr. Canna Popta (Notes Leyden Museum XXII 1900, p. 71) after 4 specimens of unknown habitat, found by her among fishes, forwarded by the late Dr. Bleeker to the Leyden Museum, as there is a chance, that it may be an indo-australian species.

26. Arius caelatus C. V.

Arius caelatus Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 66.
Arius caelatoides Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 159.
Arius microgastropterygius Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 160.
Arius clypeaster Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 161.
Arius clypeastroides Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 161.
Arius chondropterygius Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 162.

Arius melanopterygius Bleeker, Verh. Bat. Gen. XXII. 1849. Bijdr. Ichthyol. Madura p. 10.
Cephalocassis caelatus Bleeker, Ichth. Arch. Prodr. I. Siluri, 1858, p. 110.
Arius caelatus Bleeker, Atl. Ichth. II. 1862, p. 35.
Arius caelatus Günther, Cat. Brit. Mus. V. 1864, p. 158..
Arius caelatus Day, Fishes of India 4°. 1878—1888, p. 459.
Arius caelatus Vinciguerra, Ann. Mus. Civ. Genova XVI. 1880, p. 173.

B. 6; D. I. 7; A. 19—20; P. I. 9; V. 6.

Elongate. Height $4^2/_3$ to more than 5. Head $3^1/_2$ to nearly 4, its greatest width equal to its length without snout. Upper surface of head granulated. Occipital process carinated, its sides nearly parallel, as long as or slightly longer than its base, which is not much broader than its concave end, which is connected with the small, crescent shaped, corrugated basal bone of the dorsal spine. The narrow median fontanel, beginning behind the eye, reaches to the keel of the occipital process. Dorsal profile sloping downwards in a straight line. Eye $4—5^1/_3$, with a free orbital margin, $2^1/_5$ in postorbital part of head, about twice in the interorbital space and less than twice in the rounded, obtuse, slightly prominent snout. Maxillary barbels extend to the middle or to the end of the pectoral fin, mandibulary barbels to half of pectorals, mental ones $^1/_2$ shorter. Height of dorsal about equal to length of head. Dorsal spine produced into a soft, long filament, its osseous part equal to head, very strong, particularly in its basal half, granulated anteriorly, serrated behind. Adipose fin considerably shorter than dorsal, more than thrice in its distance from dorsal, opposite to anterior half of anal, the height of which is nearly equal to the length of the ventrals, which reach to the origin of the anal and are longer than head without its postorbital part. Pectorals somewhat shorter than head, their spine shorter and less strong than the dorsal one. Caudal deeply forked. Villiform teeth in the jaws in an arcuate band. On the palate in two widely separate, triangular patches, the anterior rounded base of which is considerably longer than their height. About 8 stiff, flattened gillrakers, which are about equal to $^1/_3$ of the eye. Blackish above, dark grey below. Adipose fin black, at least the distal part of the fins blackish. Length over 300 mm.

Fig. 134. *Arius caelatus* C. V. Teeth of upper jaw and palate × $1^2/_3$.

Nomen indig.: Uteh (Madur.), Manjong pidada (Mal. Batav.), Keteng (Jav.), Gunggut (Banjerm.).

Habitat: Java (Batavia, Surabaya, Pasuruan); Madura; Sumatra (Padang, Djambi!, Bagan api api!); Borneo (Banjermassin!, Balikpapan!, Sarawak, Moratabas (Brit. Mus.)). — Siam westwards to Bombay.

In sea, rivers and brackish water.

27. Arius utik Blkr.

Arius oetik Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 166.
Cephalocassis utik Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 115.
Arius utik Bleeker, Atl. Ichth. II. 1862, p. 34.
Arius utik Günther, Cat. Brit. Mus. V. 1864, p. 160.

B. 6; D. I. 7; A. 18—19; P. I. 10; V. 6.

Elongate, height (under dorsal spine) $4^3/_4$—$5^1/_2$, head $3^1/_4$—$3^1/_2$, broader than high, its greatest width $^2/_3$ of its length. Crown of head smooth or nearly so, occipital process with a median crest, triangular, a little longer than broad and slightly granulated, its truncate hindborder touching the granulate basal bone of dorsal spine. A slitlike median fontanel beginning behind the eyes and running to occipital keel. Humeral process triangular, smooth. Eye with a free orbital margin, about 5 in head, its hindborder in the middle of the length of the head, about $1^1/_2$ times in snout and 2 times in interorbital space. Dorsal profile sloping down in a straight line to the somewhat conical, bluntly rounded, slightly prominent snout. Maxillary barbels extend to the root of the pectorals, mandibulary barbels to the hindborder of the gillmembrane, mental ones

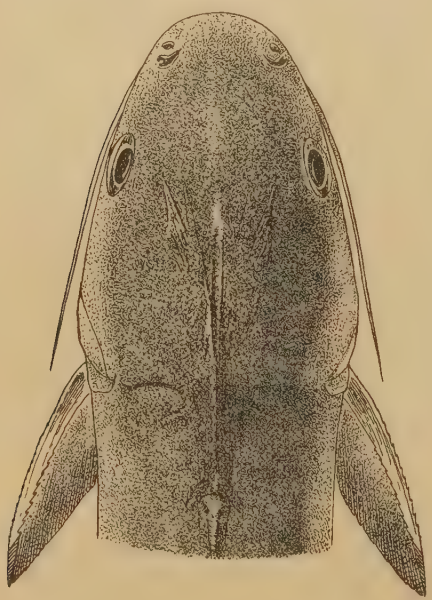


Fig. 135. *Arius utik* Blkr. × $^5/_6$.

conspicuously shorter. Height of pointed dorsal much longer than head without snout, its spine terminates in a soft filament and is rather weak, corrugated and dentated on both sides and somewhat shorter than head without snout. Adipose fin small, its base rather shorter than that of the dorsal, about thrice its distance from it, situated above the middle of the anal. Height of anal, the hindborder of which is slightly concave, is less than the length of the ventrals, which extend to its origin. Pectorals more than $^2/_3$ of the head, their weak spine is serrated on both sides, especially on its hindborder; nearly as long as that of the dorsal fin. Caudal deeply incised, pointed upperlobe the longer. Villiform teeth in the jaws in an arcuate band, those on the palate conical and pointed, forming two irregular, triangular, widely separate patches, the point of which is directed backwards. 10 stiff, somewhat flattened gillrakers, shorter than branchial filaments. Brownish above, whitish below, fins yellowish, with a darkish hue. Length 225 mm.

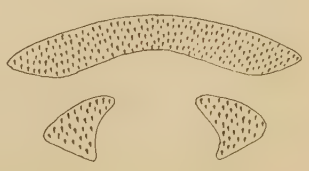


Fig. 136. *Arius utik* Blkr. Teeth of upper jaw and palate × 2.

Nomen indig.: Ikan manjong utik (Malay. Batav.).

Habitat: Java (Batavia!). Borneo (mouth of river Kapuas). In sea and estuaries.

28. Arius doriae Vinc.

Arius Doriae Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 174.

D. 1. 7; A. 17—18; P. 1. 9.

Height 5; head $3^1/_3$, its width about $1^1/_3$ in its length. Headshields smooth, only the occipital part with few granules and rugosities. Occipital process triangular and about as long as broad or a little longer than broad at its base. Its hindborder is totally united with the crescent-shaped basal bone of the dorsal spine, the ends of which are prolonged. The superficial median fontanel begins on the snout and ends in a point at the base of the occipital process. Eyes 8—9, situated in the anterior third of the head, $3^1/_2$ times in the convex interorbital space. The broad snout is rounded, its anterior margin arcuate, its length a little more than $^1/_3$ of the head. Maxillary barbels reaching the middle of the pectorals, mandi-

bulary barbels to the base of the pectorals, the mental ones extending farther than the gillopening. Height of dorsal more than height of body and twice its base; strong dorsal spine, $^4/_5$ of the head, its frontborder rough in its lower half, slightly dentated in its upper half, hindborder strongly serrated. Base of adipose fin equal to that of the dorsal and not more than twice in its distance from it. Anal emarginate, not much higher than long, $^1/_3$ longer than the adipose fin. Ventrals shorter than pectorals, which go $1^1/_2$ in length of head; pectoral spine as long as or a little longer and stronger than the dorsal spine, serrated on both borders. Caudal forked. The short, pointed teeth form in the upper jaw a slightly arcuate band, the length of which is 5 times its breadth; in the lower jaw they form a semicircle, with a narrow median interruption. The villiform teeth on the palate in two separate, subtriangular patches with an anterior point, about as broad as the eye. Uniform brown. Length 125 mm. (without C.). [After Vinciguerra, not seen by us].

Habitat: Borneo (Sarawak).

29. Arius venosus C. V.

? *Arius sumatranus* Bennett, Cat. Zool. Spec. in Life of Raffles, 4°. 1830, p. 691 (insufficient description).
Arius venosus Cuvier & Valenciennes, Hist. Nat. Poiss. XV. 1840, p. 69.
Arius micronotacanthus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 162.
Arius manjong Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 163.
Arius macruropterygius Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 164.
Arius micruropterygius Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 164.
Arius laeviceps, Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 165.
Arius venosus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 165.
Cephalocassis venosus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 113.
Arius venosus Bleeker, Atl. Ichth. II. 1862, p. 33.
Arius venosus Günther, Cat. Brit. Mus. V. 1864, p. 159.
Arius sumatranus Günther, Cat. Brit. Mus, V. 1864, p. 162.
Arius sumatranus Day, Fishes of India 4°. 1878—1888, p. 460.
Arius venosus Day, Fishes of India 4°. 1878—1888, p. 460.
Arius venosus Duncker, Mitth. Naturh. Mus. Hamburg, XXI. 1904, p. 174.
Tachysurus venosus Seale, Philippine Journ. Science V. 1910, p. 266.

B. 6; D. I. 7; A. 18—23; P. I. 10; V. 6.

Elongate. Height about 5; head about 4, its greatest width $1^1/_4$ or $1^1/_3$ in its length. Crown of head nearly smooth, few

rugosities bordering the very narrow and short median fontanel, which reaches to the median keel of the triangular occipital process, That process is slightly longer than broad at its base and concave at its hindborder, which touches the basal bone of the dorsal spine. Dorsal profile sloping down in a straight line. Eye 4—4$^1/_2$, with a free orbital margin, slightly more than half the width of the interorbital space, more than half the length of the snout, which is rounded and prominent. Maxillary barbels extend to or beyond the root of the pectorals, mandibulary barbels beyond the gillmembranes, mental ones somewhat shorter. Height of dorsal shorter than head, higher than the body; osseous part of its spine equal to head behind posterior nostril, granulated in front, serrated behind. Base of adipose fin shorter than dorsal, about 4 times in its distance from lastnamed, situated above the middle of the anal fin, the height of which is shorter than that of the dorsal and equal to the length of the ventrals, which reach on it. Pectorals slightly longer, their flattened spine nearly as long as the dorsal one, granulated in front, strongly serrated behind. Caudal deeply incised. Villiform teeth in upper jaw in a slightly arcuated, broad band; in the lower jaw in a divided, somewhat narrower band; on the palate in two triangular patches, the length of which is equal to the curved anterior base. 11 stiff, cylindrical gillrakers, ventrally decreasing in size, the longest equal to $^1/_3$ of eye. Dark reddish brown above, whitish grey below. Fins hyaline, the unpaired distally, the paired ones above blackish. Length about 260 mm.

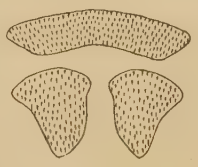


Fig. 137. *Arius venosus* C.V. Teeth of upper jaw and palate × $^5/_6$.

Nomen indig.: Manjong utik, Manjur duri, (Malay. Batav.).

Habitat: Java (Batavia, Surabaya); Borneo (Balikpapan!, Moratabas (Brit. Mus.) Sandakan); Madura; Bintang; Banka; Singapore. — Malacca, Burma, Andamans, Ceylon, Seas of Madagascar.

In sea.

Doubtful species.

We can not make out the exact position of the following species:

30. Arius brevirostris Steind.

Arius brevirostris Steindachner, Abh. Senckenb. Naturf. Gesellsch. XXV. 1901, p. 447.

D. I. 7; P. I. 9; A. 20.

The dorsal profile of head ascends in a convex line from anterior end of head regularly to dorsal. Snout and front transversely slightly convex, occipital part more strongly so, mesially carinated on occiput and granulated as the front. Cleft of mouth transverse, slightly curved, broad. Upperborder of mouth scarcely prominent above the lower. Nostrils large, those of one side separated by a cutaneous fold. Occipital process with its base slightly broader than it is long, extending to the narrow, semilunar basal bone of dorsal spine, where it is truncated with a slight curve. Head about $3^3/_5$. Eye 5, snout somewhat more than $3^1/_2$, breadth of cleft of mouth more than $1^2/_3$, height below origin of dorsal $1^1/_2$, at caudal peduncle 3, length of pectorals as also that of caudal and height of dorsal 1 in head. The band of teeth on the palate narrow, curved, mesially separated by a small interspace. Each of the two halves has one constriction. The teeth are very small, granular, whereas those in the jaws are fine and villiform. Length of maxillary barbels about $2^1/_2$ times in length of body. Outer mandibulary barbels slightly more than once in length of head. The maxillary barbels extend with their point nearly to posterior end of pectorals. The spine of dorsal and pectoral is strong, flexible towards its end, and only weakly and sparingly denticulated at its posterior border. Length of base of anal somewhat more than $1^1/_2$, that of the dorsal about $2^1/_2$, that of the adipose fin about $2^3/_5$ in length of head. Adipose fin orginates at some distance behind vertical through origin of anal and ends shortly before end of anal. Ventrals half as long as head and reaching with their point to begin of anal. Caudal deeply crescentic, the median rays about half as long as the longest of the slender lobes. Sides of head and trunk above plumbaceous, below silvery. Upper side of head with yellowish green metallic hue. Barbels, rays of pectorals (with exception of their spine) and anal, lower half of anal and margin of caudal, dark greyish violet. Length of the single specimen 73 mm. [Translated from Steindachner, not seen by us].

Habitat: Borneo (Baram river).

2. Ketengus Bleeker.

(Bleeker, Verh. Bat. Gen. XXI. I. 1847, Nieuwe bijdr. Silur. p. 9).

Elongate, head large, very broad, with a short, obtuse, prominent snout. Headshields naked. Eyes in the anterior half of the head, with a free orbital margin. Nostrils very close together, the small anterior one with a circular rim, separated by a large valve from the larger posterior one. Mouth opening wide, arcuate, reaching behind eye. 6 small barbels, a maxillary one before the angle of the mouth, a pair of mandibulary and mental ones in an arcuate line on the chin. Short dorsal with a pungent, denticulated spine and 7 rays. Adipose fin short, opposite to anal. Ventrals 6-rayed, reaching anal, their origin far behind the end of the base of the dorsal. Pectorals with a pungent, denticulated spine. Caudal forked. A single series of closely-set, small, incisor-like teeth, obtusely tricuspid or subtruncated. Palate edentulous. Gill-membranes confluent and broadly united with the isthmus, having a free posterior margin without notch. Branchiostegal rays 5.

Fig. 138. *Ketengus typus* Blkr. × 2/3.

1. Ketengus typus Blkr.

Ketengus typus Bleeker, Verh. Bat. Gen. XXI. I. 1847, Nieuwe bijdr. Silur. p. 9.
Pimelodus pectinidens Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1243.
Ketengus typus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 242. — Atl. Ichth. II. 1862, p. 44.
Ketengus typus Günther, Cat. Brit. Mus. V. 1864, p. 177.
Ketengus typus Day, Fishes of India 4°. 1878—1888, p. 468.

B. 5; D. I. 7; A. 19—20; P. I. 7—8; V. 6.

Height $4^1/_2$—5; head $4^1/_4$—$4^1/_2$, slightly longer than broad. Headshields granular. Occipital process triangular, longer than

broad at its base, its posterior end emarginated and receiving the crescentic, granular basal bone of dorsal spine. The median fontanel does not extend to base of occipital process. Eye $3—4^3/_4$. Maxillary and mandibulary barbels equal to eye, the mental ones shorter. Height of dorsal equal to head. Dorsal spine serrated on both sides and about of the length of the head. Base of adipose fin equal to that of soft dorsal, about thrice in its distance from that fin. Height of anal much less than that of dorsal. Pectoral spine denticulated at both edges, shorter than head. Caudal bifurcate, the upper lobe the longer. Darkish above, whitish silvery below, all over with a metallic hue. Fins yellowish. Length 240 mm.

Nomen indig.: Keteng (Madura).

Habitat: Java (Surabaya); Madura; Sumatra (Palembang); Borneo (rivers Barito and Mahakam!). — Pinang, Siam, Andamans.

In rivers and in brackish water near the shore.

3. **Tetranesodon** M. Weber.

(Max Weber, Nova Guinea IX. livr. 4. 1913, p. 545).

Head conical, snout conical, strongly prominent before small, transverse inferior mouth, the lips of which are internally swollen. Nostrils close together, lateral, the posterior with a valve. A pair of short maxillary, mandibulary and mental barbels. Headshields rugose, covered with thin skin. Occipital process touching the basal bone of dorsal spine. Eye of medium size, lateral, with free orbital margin. Dorsal with 7 rays and a pungent spine, originating in the middle between pectorals and ventrals. Adipose fin moderate, above anal. Ventrals six-rayed. Pectorals with a pungent spine. Caudal forked. Axillary pore present. On each side in the jaws a narrow patch of conical teeth, few in number. Palate edentulous. Gillmembranes united, in their middle connected with the isthmus, with a free posterior margin. Ventral branch of first branchial arch with few (8) gillrakers. 6 branchiostegal rays.

1. **Tetranesodon conorhynchus** M. Web.

Tetranesodon conorhynchus Max Weber, Nova Guinea IX. livr. 4. 1913, p. 546.

B. 6; D. I. 7; A. 17; P. I. 10; V. 6.

Elongate. Height below dorsal spine somewhat more than 6;

head 5, its breadth $1^2/_5$ in its length, its dorsal profile slightly convex, slowly sloping down to the snout, which is bluntly conical. Its lower border runs in a somewhat oblique and posterior direction to the upperlip, which borders in a semicircle the quite inferior mouth. A vertical through the mouth is nearer to the eye than to the point of the snout, it is only about $^1/_5$ of the length of the head. The somewhat swollen lips are connected by a rather broad fold. Nostrils close together, situated below a horizontal connecting eye and point of snout. Crownshield with undulating rugae, radiating from a central point. Occipital process keeled, $^1/_2$ longer than broad at its base, its rectilinear sideborders converging, its truncate hindborder somewhat emarginated and touching the rugous, crescentic basal bone

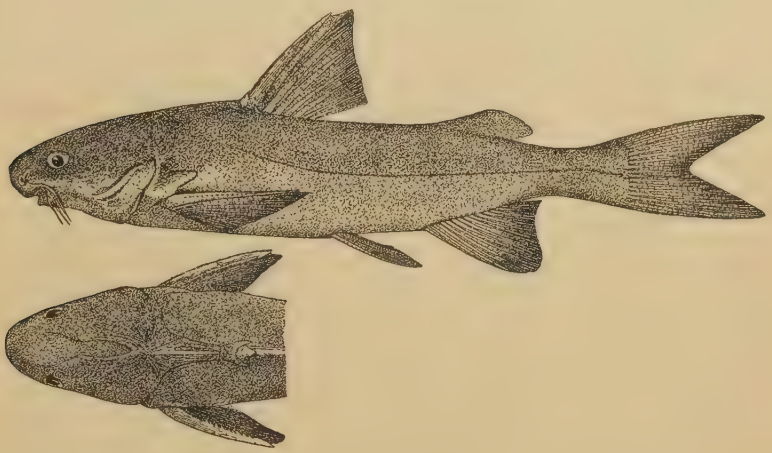


Fig. 139. *Tetranesodon conorhynchus* M. Web.

of the dorsal spine. Before the crownshield a narrow, oval fontanel about as long as snout. Humeral process rugous, elongate and truncate. Eye lateral, situated in the anterior half of head, $6^2/_5$ in head, twice in snout and $2^1/_2$ times in the very convex interorbital space. Maxillary barbels $2^1/_2$ times in head, reaching nearly halfway to posterior border of opercle, mandibulary barbels $^1/_3$ longer than eye, mental barbels slightly shorter. Mandibulary and mental barbels originating close together in one line. Height of dorsal equal to head from posterior nostril, its spine slightly shorter, flattened, anteriorly with weak, posteriorly with stronger serrations. Base of adipose fin longer than dorsal, its distance from dorsal $^1/_2$ its

length. Height of anal nearly equal to head without snout, ventrals somewhat shorter, not reaching on anal. Pectorals about equal to dorsal, their spine of equal length, longer than dorsal spine, anteriorly with blunt, posteriorly with long, pointed teeth. Caudal deeply forked, the pointed lobes thrice as long as the median rays. Least height of caudal peduncle nearly thrice in its length. In each oval maxillary patch nearly 10 conical teeth, the mandibulary patches are smaller and triangular and have about an equal number of teeth. All teeth are depressible. 8 stiff, flattened gillrakers, considerably shorter than the branchial filaments. Dark bluish, underside of head and belly whitish with a silvery hue, increasing on sides and tail. Fins dark brown. Length of single specimen 210 mm.

Habitat: South New Guinea (Lorentz river!).

4. **Nedystoma** Ogilby.

(I. Douglas Ogilby, Proc. Linn. Soc. N. S. Wales, 1898, p. 32).

Head scarcely depressed but little wider than deep. Mouth moderate, transverse, upper jaw projecting. Nostrils close together, no nasal barbel. Maxillary, mandibulary and mental barbels slender and short. Median fontanel ending dilated and rounded midway in the rounded occipital shield, which is not covered by skin. Occipital process touching the basal bone of the dorsal spine. Eyes rather large, only anteriorly with a free orbital margin. Dorsal with 7 rays and a pungent spine, originating midway between pectorals and ventrals. Adipose fin rather small, above the anal. Pectorals with a pungent spine. Ventrals with 6 rays. Caudal deeply forked. Axillary pore present. Jaws with one or two series of feeble, somewhat deciduous teeth. Palate edentulous. Gillmembranes united, attached to the isthmus along the median line and confluent with its skin, without forming a free margin. On the lower branch of the first branchial arch numerous (23) long, cylindrical gillrakers, internally from them a series of more than 30 low, triangular processes. 6 branchiostegals.

1. **Nedystoma dayi** (Ramsay & Ogilby).

Hemipimelodus Dayi Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales (2). I 1886, p. 16.

Nedystoma Dayi I. Douglas Ogilby, Proc. Linn. Soc. N. S. Wales 1898, p. 33.

Nedystoma Dayi Max Weber, Nova Guinea IX. livr. 4. 1913, p. 548.

B. 6; D. II. 7; A. 20—21; P. I. 10; V. 6.

Elongate, height below dorsal spine 4—$4^2/_5$, head $3^1/_3$—$3^1/_2$, its width $1^2/_5$ in its length. Dorsal profile somewhat irregularly and slowly sloping down to the rounded, blunt, somewhat spongy, thickened snout, prominent in front of the nearly transverse gape of mouth, the length of which goes nearly $2^1/_2$ times in head. Crown of head with furrows and granulate rugae, radiating from a central prominence. The proper occipital process with parallel borders, twice as long as broad, touching with

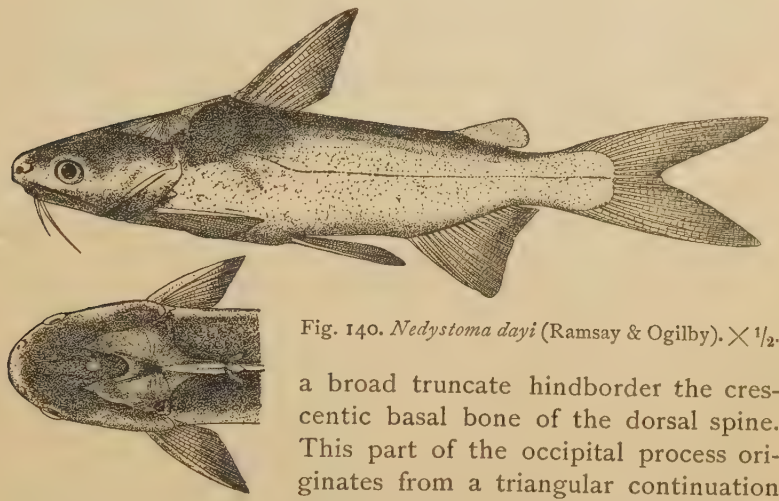


Fig. 140. *Nedystoma dayi* (Ramsay & Ogilby). × $^1/_2$.

a broad truncate hindborder the crescentic basal bone of the dorsal spine. This part of the occipital process originates from a triangular continuation of the occipital shield. The occipital shield has anteriorly a deep rounded incisure for the median fontanel, which narrows anteriorly. On both sides bordered by a ridge; besides a narrow bony ridge runs on both sides from the anterior border of the occipital shield to above the frontborder of the eye. Humeral process triangular, with a broad base and sharp posterior point. Eyes only anteriorly with a vestigial orbital ring; more than 5 times in head, $1^1/_2$ in snout, 2—$2^1/_2$ in the slightly convex interorbital space, which goes about $2^1/_2$ times in head. Maxillary barbels extend to the posterior border of the gillmembrane or somewhat farther, as also the shorter mandibulary barbels, the mental barbels $^1/_3$ shorter. Dorsal equal to head or slightly shorter. Dorsal spine flattened, its frontborder slightly serrated only at its top, posterior border with rough teeth, its length much more than that of head without snout, in small specimens nearly equal

to head. Base of adipose fin somewhat shorter than dorsal, it goes in small specimens more than twice, in larger nearly thrice in its distance from dorsal. Height of concave anal equal to head without snout or somewhat less. Ventrals reaching the anal, equalling in length the height of lastnamed. Pectorals as long as head without snout or longer, osseous part of their spine slightly shorter but much longer than dorsal spine, flattened and serrated at its hindborder only. Caudal deeply incised, the pointed lobes nearly 3 times longer than median rays. Least part of caudal peduncle about twice in its length. The very minute teeth form in the jaws a narrow, slightly curved band of one or two rows. Lower part of first branchial arch with 23 cylindrical, stiff gillrakers, broadened at their base, the longest equalling the branchial filaments; mesially on the same arch is a parallel row of more than 30 low, triangular processes with a swollen top. Colour silvery, above dark blue, crown yellowish brown, fins hyaline, more or less darkish at their margin. Length about 240 mm.

Habitat: South New Guinea (Strickland river, Lorentz river!).

5. **Hemipimelodus** Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 236).

Head more or less depressed. Mouth transverse, moderate or small, snout prominent or even projecting and gibbous. Nostrils close together, no nasal barbel. Maxillary, mandibulary and mental barbels slender, rather long. Headshields visible or more or less covered by skin. Occipital process touching the basal bone of the dorsal spine. Eyes with or without a free orbital margin. Dorsal with 7 rays and a pungent spine, originating midway between ventrals and pectorals or nearer to lastnamed. Adipose fin of moderate length or short, originating above or slightly before the anal. Pectorals with a pungent spine. Ventrals with 6 rays. Caudal deeply forked. Axillary pore present. Jaws with a band of villiform teeth. Palate edentulous. Gillmembranes united, attached to the isthmus along the median line, leaving a narrow margin free. On the lower branch of the first branchial arch a moderate number of short, more or less conical gillrakers. 5—6 branchiostegals.

Synopsis of the species.

A. Free orbital margin present.

1. Adipose fin originating in advance of the anal. Band of intermaxillary teeth transversely divided by a naked groove, behind which the teeth are small and decumbent. Axillary pore present . . . . . *H. crassilabris* p. 323.
2. Adipose fin totally above the anal. Intermaxillaries with a compact band of villiform teeth. No axillary pore.
   a. 8 gillrakers. A. 19—20, snout conical, strongly prominent, eye about $5^1/_2$ in head . . . . . *H. macrorhynchus* p. 324.
   b. 12 gillrakers. A. 15, snout flat, rounded, slightly prominent, eye about 7 in head . . . . . *H. velutinus* p. 325.

B. No free orbital margin, axillary pore present.

1. Head 4—$4^1/_2$, eye 7—8, dorsal spine equal to or shorter than head and equal to pectoral spine *H. borneensis* p. 327.
2. Head $3^2/_5$—$3^1/_4$.
   a. eye 8, dorsal spine $^2/_3$ of head, equal to pectoral spine. . . . . *H. macrocephalus* p. 327.
   b. eye 11—12, dorsal spine equal to or shorter than head, longer than pectoral spine . . . . *H. intermedius* p. 328.

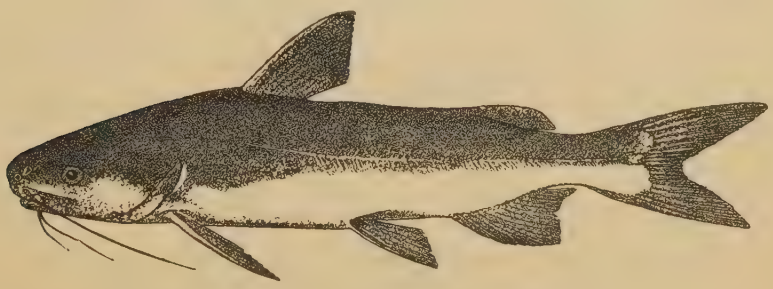


Fig. 141. *Hemipimelodus velutinus* M. Web. About × $^1/_2$.

1. **Hemipimelodus crassilabris** Ramsay & Ogilby.

Hemipimelodus crassilabris Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales (2). I. 1886, p. 18.

Pachyula crassilabris I. Douglas Ogilby, Proc. Linn. Soc. N. S. Wales. 1898, p. 33.

B. 5; D. I. 7; A. 18; P. I. 12; V. 6.

Height $5^1/_3$ in the total length, head $4^3/_7$ in the total length, depressed anteriorly, wider than deep, the nuchal region elevated. Width of head equal to head without snout. Occiput feebly and obtusely ridged. Occipital process triangular, its

breadth at the base nearly equal to its length. Occipital fontanel dilated and cardiform. Mouth small and transverse, the width of the gape is $^1/_4$ of the length of the head, lips thick, the upper terminating in a broad, free lobe. Upper jaw well projecting and somewhat gibbous anteriorly. Eyes $5^5/_6$, small, supero-lateral, surrounded by a fleshy lid, $2^1/_4$ in snout and $1^1/_2$ in the interorbital space. Maxillary barbels not quite reaching to gillcoverts, mandibulary and mental barbels close together on the same transverse plane, short. Dorsal fin a little higher than the body, its spine roughened in front, weakly serrated behind and $^1/_{10}$ of the length of head, originating much nearer to the pectorals than to the ventrals; the base of the rayed dorsal is $^4/_5$ of that of the adipose fin, which is rather long and low, originating well in advance of the anal. Pectoral spine a little shorter but stouter than the dorsal spine, equal to the width of the head; it is roughened outside, finely serrated inside; they do not nearly reach the ventrals, which themselves do not reach the anal. Caudal deeply forked. Jaws with bands of villiform teeth, that of the maxillaries wide and transversely divided by a naked groove, behind which the teeth are smaller and decumbent. Mandibular band narrow. Gillrakers small, conical, in moderate number. Brown above, yellowish white below, the pectoral region silvery. Basal half of dorsal and anal fins yellowish white, remainder of fins brown; inner surface of pectorals blue at the base. Length about 200 mm. [After Ramsay & Ogilby; not seen by us].

Habitat: South New Guinea (Strickland river).

2. Hemipimelodus macrorhynchus M. Web.

Hemipimelodus macrorhynchus Max Weber, Nova Guinea IX. Zool. livr. 4, 1913, p. 549.

B. 6; D. I. 7; A. 19—20; P. I. 10; V. 6.

Elongate. Height under dorsal spine $5^3/_5$, head nearly 4. Dorsal profile slightly convex above the opercle, otherwise slowly sloping down to the conical snout, which forms a prominent cone, rapidly decreasing in seize. Mouth inferior, slightly rounded, $2^3/_4$ in head, when closed only the posterior part of the maxillary band of teeth is covered. The horizontal connecting the middle of the frontborder of the eye with the

point of the snout runs between the posterior and anterior nostril. A thin skin covers the headshields, which have reticulate rugae. Occipital process keeled, its sideborders slightly converging, its length about $1^1/_2$ the breadth of its base, posteriorly rounded and touching the narrow crescentic basal bone of the dorsal spine. The long, narrow, elliptic median fontanel reaches to the occipital process. Humeral process triangular, pointed, with a longitudinal crest. Eyes $5^1/_2$, lateral, with conspicuous free orbital margin, situated in the anterior half of the head, about 2 times in snout and about $2^1/_2$ times in the convex interorbital space. Maxillary barbels reach half way on the pectorals or somewhat farther, mandibulary barbels half as long, the mental ones still shorter, reaching to the gillmembrane. Dorsal originating nearer to the pectorals than to the ventrals, equal to length of head from posterior nostril; dorsal spine flattened, both its borders weakly serrated, somewhat longer than head without snout. Base of adipose fin shorter than that of dorsal, thrice in its distance from last-named (less in young specimens). Height of anal somewhat more than postorbital part of head, its inferior border concave. Ventrals equal to postorbital part of head, they don't reach the anal. Pectorals equal to head without snout, their spine somewhat shorter, equal to dorsal spine or slightly shorter, flattened, frontborder weakly, serrated hindborder strongly so. Caudal deeply forked, the pointed lobes 3 times longer than the median rays. Least height of caudal peduncle at least two times in its length. No axillary pore. Villiform teeth in upperjaw in a curved band, 8 times broader than long. The two slightly separated bands in the lower jaw are somewhat narrower. Eight stiff flattened gillrakers considerably shorter than branchial filaments. Colour dorsally grey brown, sides silvery, lower surface of head and belly white. Fins, especially their distal part, darkish. Length 175 mm.

Habitat: South New Guinea (Lorentz-river!).

3. **Hemipimelodus velutinus** M. Web. [Fig. 141, p. 323].

Hemipimelodus velutinus Max Weber, Nova Guinea V. Zool. livr. 2, 1908, p. 225. — Ibid. IX, livr. 4, 1913, p. 549.

B. 6; D. I. 7; A. 15; P. I. 10; V. 6.

Elongate; height $5^1/_2$, head $3^1/_4$, broader than high, its

breadth $^4/_5$ of its length. Dorsal profile with a slight convexity sloping down to the broad, slightly prominent, rounded snout. Mouth slightly rounded, more than twice in head, when closed only the posterior part of the maxillary band of teeth is covered. Nostrils above a line, connecting the middle of the eye and the point of the snout. Head covered by skin, its posterior part granulated. Occipital process keeled, somewhat longer than the breadth of its base, its lateral borders nearly parallel, its hindborder touching the basal bone of the dorsal spine. Median fontanel shallow, rhombic, situated between posterior nostrils and occipital process. Humeral process rather long and pointed. Eyes about 7, nearly lateral, with a free orbital margin situated in the anterior half of the head, $2^1/_4$–$2^1/_2$ in the snout, $4^1/_4$–$4^1/_2$ in the slightly convex interorbital space. Maxillary barbels extending to base of pectorals or somewhat farther, mandibular barbels to base of pectorals, mental ones conspicuously shorter. Dorsal originates midway between pectorals and ventrals; nearly equal to head from posterior nostril; osseous part of dorsal spine equal to head without snout, flattened, the fine granules of its frontborder are distally coarser, hindborder serrated. Base of adipose fin as long as dorsal, its distance from lastnamed fin about $2^1/_2$ times its length. Anal emarginate, its height about equal to postorbital part of head, ventrals of about the same length, reaching anal or nearly so. Pectorals 1 eyediameter longer than head without snout, their spine in length and otherwise equal to dorsal spine. Caudal deeply forked, its lobes pointed, more than thrice in the longest median rays. Least height of caudal peduncle $1^1/_2$ times its length. Crescentic maxillary band of villiform teeth 6 times broader than long, the band of the lower jaw nearly similar but laterally pointed. About 12 short, stiff gillrakers, broadened at their base, the most lateral ones very short. Dorsal surface and sides of a lighter or darker steel colour, gradually passing into the yellow white of the lower surface. Fins dark, margin of anal and pectorals and innerside of ventrals lighter. Length abouth 350 mm.

Nomen indig.: Kantjur (Sentani).

Habitat: North New Guinea (Lake Sentani!, river Tami!, and its tributaries!, river Tawarin!).

In fresh water.

4. Hemipimelodus borneensis (Blkr.).

Pimelodus borneensis Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 430.
Hemipimelodus borneensis Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 238. — Atl. Ichth. II. 1862, p. 43.
Hemipimelodus borneensis Günther, Cat. Brit. Mus. V. 1864, p. 176.

B. 5; D. I. 7; A. 18—20; P. I. 9—10; V. 6.

Elongate. Height 5—$5^2/_5$, head 4—$4^1/_2$, its breadth $1^1/_3$—$1^1/_5$ in its length. Rostro-dorsal profile of head and neck convex. Head granulated above, occipital process keeled, triangular, longer than broad, extending on to the short basal bone of the dorsal spine. A long median fontanel reaching to the occipital process. Snout obtusely rounded, slightly prominent. Mouth rather small, $2^2/_3$—3 in length of head, transverse. The maxillary barbels extend to the end of the head, the mandibulary barbels do not reach the branchial opening and are longer than the mental ones. The eyes 7—8, small, covered by skin, situated between the anterior and middle thirds of the head, thrice in the width of the interorbital space and about twice in the length of the snout. Dorsal about as long as height of body, its spine strong, serrated behind, as long as or shorter than the head. Base of adipose fin rather longer than the dorsal, its length being more than half its distance from the dorsal. Anal slightly emarginate, little longer than adipose fin. Ventrals $1^2/_5$—$1^3/_5$ in length of head. Pectorals a little shorter than head, their spine strong, as long as that of the dorsal or a little longer, strongly serrated behind, weakly at the top of its frontborder. Caudal forked, with pointed lobes. Villiform teeth in a slightly curved band in the upper jaw, the band in the lower jaw more curved, broader, but antero-posteriorly shorter. Olivaceous above, margariteceous below. Length 200 mm. [Not seen by us].

Nom. indig.: Anak dukang (Palembang).

Habitat: Sumatra (Palembang); Borneo (Sarawak, rivers Barito and Sambas. — Siam.

In rivers.

5. Hemipimelodus macrocephalus Blkr.

Hemipimelodus macrocephalus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 239. — Atl. Ichth. II. 1862, p. 43.
Hemipimelodus macrocephalus Günther, Cat. Brit. Mus. V. 1864, p. 176.

B. 5; D. I. 7; A. 19—20; P. I. 10; V. 6.

Elongate; height $5^1/_3$—$5^3/_5$, head $3^2/_5$—$3^1/_4$, its breadth about $1^1/_2$ in its length. In the rostro-dorsal profile the snout and the neck are convex, the front and crown of the head slope in a straight line. Occipital process carinated, triangular, rather longer than broad, extending to the small basal bone of the dorsal spine. A long median fontanel reaching almost to the occipital process. Snout obtusely rounded, slightly prominent. Mouth 3 times in length of head. The maxillary barbels reach to the opercles, the mandibulary barbels do not reach so far and are longer than the mental ones. Eyes about 8, lateral, small, covered by skin situated between the anterior and middle thirds of the head, 2—$2^1/_2$ in the width of the interorbital space, about twice in the snout. Dorsal fin rather higher than the body, its spine is strong, serrated behind, $^2/_3$ of the length of the head. Base of adipose fin scarcely longer than that of dorsal, its length being less than $^1/_2$ its distance from the dorsal. Anal a little emarginate, longer than adipose fin. Ventrals about twice in head. Pectorals $1^1/_3$—$1^1/_4$ in head, their spine as long as the dorsal one, strongly serrated behind, weakly at the top of its frontborder. Caudal forked, with pointed lobes. Villiform teeth in a slightly curved band in the upper jaw, the band in the lower jaw more curved, broader, but antero-posteriorly shorter. Olivaceous above, margaritaceous below. Length 140 mm. [After Bleeker and Günther and after a specimen in the Leyden Museum, seen by us].

Habitat: Sumatra (Palembang); Borneo (river Barito).

In rivers.

6. **Hemipimelodus intermedius** Vinc.

Hemipimelodus intermedius Vinciguerra, Ann. Mus. Civ. Gen. XVI. 1880, p. 178.

B. ? D. I. 7; A. 19; P. I. 9; V. ?

Elongate; height $5^1/_3$, head $3^1/_3$, its breadth $1^2/_5$ in its length, broad, depressed. Crownshields rugose, granulate. Occipital process keeled, triangular, not much longer than broad at its base, contiguous with the basal bone of the dorsal spine. The long median fontanel reaches nearly to the occipital process. Snout rounded, slightly prominent. Maxillary barbels reach to the hindborder of the operculum, the mandibulary ones do not reach the branchial opening and are longer than the mental ones. Eyes small, 11—12 in head, situated in the

anterior third of it [1]), 4 times in the convex interorbital space. Dorsal fin much higher than the body, its height about 3 times its base, some of the rays are prolonged in filaments, its strong spine is equal to the head or a little shorter, it is serrated at the front and hindborder. The base of the adipose fin is shorter than the dorsal, its length being less than $^1/_2$ its distance from the dorsal. Anal emarginate, longer than high and about twice the length of the adipose fin. Pectorals $1^1/_3$ in the length of the head, their spine $^5/_7$ of that of the dorsal, serrated at both borders but stronger at the posterior border. Ventrals shorter than pectorals. Caudal forked, its upper lobe the longer. Teeth small, pointed, in several rows on the jaws, they form a slightly curved band in the maxillary, which is 4 times broader than long. Length about 150 mm. [After Vinciguerra, not seen by us).

Nomen indig.: Ikan Attit.

Habitat: Borneo (Sarawak).

6. Osteogeneiosus Bleeker.

(Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 173).

Elongate, head strongly depressed, covered by smooth skin. Upper jaw projecting before the arcuate mouth, with thin lips. Nostrils close together, the posterior with a valve, situated superiorly near the frontborder of the snout. Eyes lateral, with a free orbital margin. Only one pair of barbels, belonging to the maxillaries and very stiff and bony. Short dorsal with 7 rays and a pungent spine, situated between pectorals and ventrals. Adipose fin short, opposite to short anal. Pectorals with a pungent spine. Ventrals 6-rayed. Caudal forked, with rounded lobes. Villiform bands of teeth in the jaws, on the palate two separate patches of obtusely conical teeth. Gill-membranes united, their free hindborder deeply emarginate, only anteriorly connected with the isthmus. Branchiostegals 5.

1. Osteogeneiosus militaris (L.).

Silurus militaris Linné, Systema Naturae, edit. X. 1758, p. 305.
Arius militaris Cuvier & Valenciennes, Hist. Nat. Poissons, XV. 1840, p. 114.
Osteogeneiosus macrocephalus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 173.

1) "Situati nel terzo anteriore del muso" (?!).

Osteogeneiosus longiceps Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 174.
Osteogeneiosus ingluvies Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 174.
Osteogeneiosus gracilis Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 175.
Osteogeneiosus Blochii Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 175.
Osteogeneiosus Valenciennesi Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 175.
Arius militaris Cantor, Journ. Asiat. Soc. Bengal, XVIII, 1850, p. 1241.
Osteogeneiosus Valenciennesi Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 121. — Atl. Ichth. II. 1862, p. 46.
Osteogeneiosus militaris Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 123. — Atl. Ichth. II. 1862, p. 46.
Osteogeneiosus macrocephalus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 124. — Atl. Ichth. II. 1862, p. 47.
Osteogeniosus militaris Günther, Cat. Brit. Mus. V. 1864, p. 181.
Osteogeniosus valenciennesii Günther, Cat. Brit. Mus. V. 1864, p. 181.
Osteogeniosus macrocephalus Günther, Cat. Brit. Mus. V. 1864, p. 182.
Osteogeniosus militaris Kner, Novara-Exp. Fische, 1865—1867, p. 314.
Osteogeniosus Valenciennesi Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 181
Osteogeniosus militaris Day, Fishes of India 4°. 1878—1888, p. 469.

Fig. 142. *Osteogeneiosus militaris* (L.). × $^3/_5$.

B. 5; D. I. 7; A. 19—21; P. I. 9—10; V. 6.

Elongate; height $5^1/_4$—6; head $3^1/_5$—$3^2/_5$, strongly depressed, its width equal to postorbital part, its height 2—$2^1/_5$ in its length, covered by smooth skin above. Broad median fontanel not reaching base of occipital process, wich is more than twice as long as broad at its base. Eye more than 6, situated in the anterior half of the head, more than twice in the rather strongly convex interorbital space, and nearly twice in the rounded, prominent snout. Barbels extending on the base of

the pectorals. Height of dorsal more than length of postorbital part of head, dorsal spine $1^2/_5$—$1^3/_4$ in head, its frontedge granular, its posterior edge serrated. Base of adipose fin about equal to that of dorsal, more than thrice in its distance from dorsal, opposite to concave anal, the height of which is $^2/_3$ of that of the dorsal. Ventrals about $2^1/_2$ in head, far distant from anal, their origin far behind end of base of dorsal. Pectoral spine more than twice in head, denticulated at both edges. Caudal forked. Villiform bands of teeth in the jaws; on the palate two longitudinal, semioval patches of obtusely conical teeth. Back bluish, light below. Distal part of dorsal and adipose fin dark blue. Length 310 mm.

Nomen indig.: Ikan Manjong karbo (Malay. Batavia); Ikan Lundu (Semarang); Ikan keteng (Surabaya); Ikan Songop (Pasuruan).

Habitat: Java (Batavia, Semarang, Surabaya, Pasuruan); Madura; Java-Sea!; Sumatra (Bagan api api!); Borneo (Sarawak); Singapore. — Malacca to British India.

Sea, estuaries and tidal rivers.

7. **Batrachocephalus** (Bleeker.).

(Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 176).

Elongate; head large, broad, depressed, with a very short obtuse snout. Headshields naked. Eyes in the anterior half of the head, with a free orbital margin, above angle of mouth, which has a very wide, arcuate gape. The lower jaw is prominent. Nostrils very close together, the posterior separated by a valve from the anterior one, which has a circular rim, both are close to the eye. A pair of very small mandibulary barbels and indications of the mental ones. Short dorsal with a denticulated pungent spine and 7 rays. Adipose fin short, opposite to anal. Ventrals 6-rayed, reaching the anal or nearly so; their origin far behind end of base of dorsal. Pectorals with a strong, denticulated spine. Caudal forked. Obtusely conical teeth in four or five more or less complete series, forming a crescentic band in each jaw. Vomer edentulous. Palatines with a longitudinal band of conical teeth. Gillmembranes confluent and united with the isthmus, having a free posterior margin without notch. 5 Branchiostegals.

1. Batrachocephalus mino (Ham. Buch.).

Ageneiosus mino Hamilton Buchanan, Fishes of the Ganges, 1822, p. 159.
Batrachocephalus ageneiosus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 176.
Batrachocephalus micropogon Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 119. — Atl. Ichth. II. 1862, p. 48.
Batrachocephalus mino Günther, Cat. Brit. Mus. V. 1864, p. 182.
Batrachocephalus mino Day, Fishes of India 4°. 1878—1888, p. 468.

Fig. 143. *Batrachocephalus mino* (Ham. Buch.) × 4/5.

B. 5; D. I. 7; A. 19—21; P. I. 9; V. 6.

Height $4^1/_2$; head $3^2/_5$—$3^4/_5$; eye 5. Headshields forming a cross, with the surface corrugated. Occipital process longer than broad at its base, its posterior end broadly emarginate and receiving the granular semicrescentic basal bone of the dorsal spine. Height of dorsal nearly $^3/_4$ of length of head, its spine denticulated at both edges, as long as postorbital part of head. Base of adipose fin $^2/_3$ of that of dorsal, more than 4 times in its distance from that fin. Height of anal much less than that of dorsal. Pectoral spine denticulated at both edges, about equal to or slightly longer than the dorsal one. Caudal deeply forked, the upper lobe the longer. Silvery, dark brown above. Fins yellowish, powdered with dark. Length about 250 mm.

Nomen indig.: Ikan manjong kodok, Ikan utik (Malay.).

Habitat: Java (Batavia!, Surabaya); Sumatra (Palembang!); Borneo (river Kapuas, Sarawak). — Burma and British India.

In sea, estuaries and tidal rivers.

5. Fam. Doiichthyidae.

Dorsal fin short, with a pungent spine and 7 soft rays, its origin about midway between pectorals and ventrals. Adipose fin short, totally above the long anal, which has 28—30 rays. Pectorals lateral, rather low down, with a pungent spine. Ventrals 6-rayed. Caudal deeply forked. Head depressed, its dorsal shields covered by thin skin. Snout depressed, very broad; mouth very wide, terminal, jaws equal. Nostrils separated by a narrow interspace without barbel. A pair of long maxillary, mandibulary and mental barbels. Eyes small, without free orbital margin, situated behind the corner of the mouth. Minute teeth in one row in the jaws and a few in a row quite laterally on each side of the palate. Branchiostegal membranes narrow, totally free from isthmus and from each other.

1. Doiichthys M. Weber.

(Max Weber, Nova Guinea, IX. livr. 4, 1913, p. 532).

Snout depressed, very broad, mouth very wide, terminal, jaws equal. Anterior nostril at the border of the snout, the posterior nostril at a distance of its own width behind it. No nasal barbel; six long, slender barbels: maxillary, mandibulary and mental. Headshields covered by thin skin, occipital process nearly touches the narrow basal bone of dorsal spine. Eyes small, without free orbital margin, situated behind the corner of the mouth. Operculum a rhombic bone suspended by a membrane and very movable. Dorsal with 7 rays and a pungent spine, situated midway between pectorals and ventrals. Adipose fin short, above the long anal. Pectorals with a serrated spine. Ventrals 6-rayed. Caudal deeply forked. Minute teeth in one row on the jaws, a few in a row quite laterally on each side of the palate. Branchiostegal membranes narrow, totally free from isthmus and from each other, with 6 rays. Gillrakers cylindrical, long, numerous.

1. Doiichthys novae-guineae M. Web.

Doiichthys novae-guineae Max Weber, Nova Guinea IX. livr. 4, 1913, p. 534.

B. 6; D. i. 7; A. 28—30; P. 1. 10; V. 6.

Elongate. Height below the dorsal spine $5^1/_4$. Head about

$3^1/_2$—$3^3/_4$, more than $1^1/_2$ times broader than long, its posterior part convex, its dorsal profile sloping down in a straight line to the rounded, flattened snout, the breadth of which is equal to that of the head. The width of the mouth nearly $1^1/_2$ times in head.

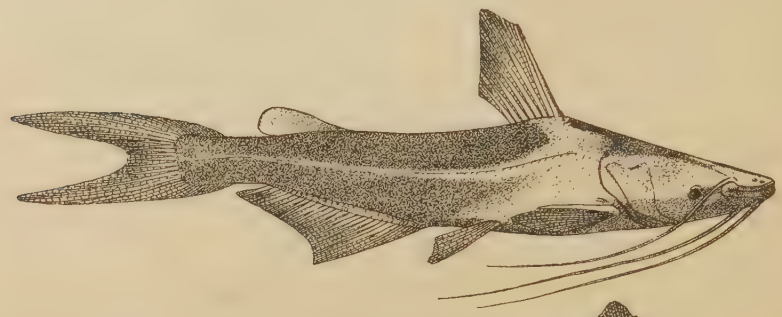
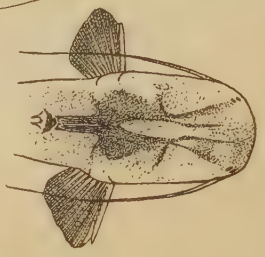


Fig. 144. *Doiichthys novae-guineae* M. Web. × 4/5.



Headshields with retiform rugae; the borders of the keeled occipital process are slightly convex, otherwise nearly parallel. The length of the process is twice the breadth at its base, its blunt hindborder is emarginated and nearly touches the anterior process of the narrow basal bone of the dorsal spine. Median fontanel elongate, wider behind. Humeral process very broad and short. Eye situated in the middle of the head, more than 1 eyediameter behind corner of mouth, $9^1/_3$ in head and about 6 times in the convexity of the interorbital space. All the barbels extending to the anterior part of the anal. Height of dorsal equal to length of head from posterior nostril, the rather weak spine about as long as head without snout, posteriorly serrated, anteriorly only a few teeth near its top. Base of adipose fin shorter than dorsal, its distance from dorsal at least thrice its length. Anal nearly equal to head, its height more than head without snout. Ventrals reaching to anal, shorter than postorbital part of head. Pectorals longer than head without snout; their spine flattened and posteriorly strongly serrated is shorter and considerably shorter than dorsal spine. Caudal deeply forked, with pointed lobes; about thrice as long as median rays. Least height of caudal peduncle more than twice in its length. About 32 slender, cylindrical gillrakers, much longer than branchial filaments,

$^1/_2$ longer than the eye. Yellowish brown, with a silvery hue on belly and sides. Fins hyaline, or the distal part of dorsal, pectorals, anal and lobes of caudal are darkish. Length about 140 mm.

Habitat: South New Guinea ("Varen"-river, a tributary of Lorentz-river!).

In fresh and brackish water.

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6. Fam. Bagridae.

Dorsal fin short, with a pungent spine and 6 to 7 soft rays, placed anteriorly in advance or partly above the ventrals, which have 6 rays. Adipose fin longer or shorter than dorsal, always well developed, opposite to the anal which has in indo-australian species less than 20 rays. Pectorals lateral, with a pungent spine. Caudal forked. Head conical or more or less depressed, covered by thick or thin skin or the headshields are even naked. Anterior and posterior nostrils wide apart, the latter with a barbel. A pair of maxillary, mandibulary and mental barbels present. Eyes subcutaneous or with a free orbital margin. Mouth transverse or crescentic, at the lower side of the snout, the upper jaw being more or less prominent. Villiform teeth in the jaws in a band; on the palate in a patch or in an uninterrupted semicrescentic band; by exception (Bagrichthys) large movable labial teeth in the lower jaw. Gill-membranes free from the isthmus, nearly totally separated or united. 7—13 branchiostegals.

Synopsis of the genera.

A. Orbital margin free. No movable labial teeth. Gill-membranes nearly totally separated . . . . . *Macrones* p. 336.

B. Eyes covered by skin.

1. Lower jaw with large movable labial teeth. Branchial membranes united. Teeth on hindborder of dorsal spine directed upward . . . . . *Bagrichthys* p. 345.
2. No labial teeth.
   - *a.* Gill-membranes totally united. Teeth on hindborder of dorsal spine directed upward. . . . . *Bagroides* p. 347.
   - *b.* Gill-membranes nearly totally separated. Hindborder of dorsal spine smooth or with the teeth directed downward . . . . . *Leiocassis* p. 351.

1. Macrones Duméril.

(C. Duméril, *Ichthyologie analyt.* 1856, p. 484).

(*Hypselobagrus, Hemibagrus, Aspidobagrus* Bleeker).

Elongate. Head more or less depressed, smooth or rugose above, covered by thin skin, with a median fontanel. Occipital process reaching or not reaching to basal bone of dorsal spine. Snout prominent, mouth arcuate, lips thin. Eyes with a free orbital margin. 8 barbels of different length. A short dorsal with a pungent spine, its hindborder more or less serrated behind. Adipose fin much longer or shorter than anal, which has less than 20 rays and is opposed to it. Pectorals with a pungent spine, denticulated behind. Origin of ventrals below or behind end of dorsal. Caudal deeply forked. Teeth in bands in the jaws, in a curved band on the palate. Gillmembranes nearly totally separated, free from isthmus. Branchiostegals 8—13.

Fig. 145. *Macrones nigriceps* (C. V.). × 3/5.

Synopsis of the species.

I. Adipose fin much longer than anal.
  a. Median fontanel extending to base of occipital process.
    α. Adipose fin contiguous with dorsal. . . . . *M. nigriceps* p. 337.
    β. Adipose fin commencing at a distance from dorsal . . . . . *M. baramensis* p. 338.
  b. End of median fontanel far distant from base of occipital process . . . . . *M. micracanthus* p. 339.

II. Adipose fin about equal to anal.
  a. Upper surface of head rugose.

1. Nasal barbel longer than head; maxillary barbel extending to caudal. Height 4—4$^1/_4$, head somewhat more. . . . . *M. wolffi* p. 340.
2. Nasal barbel reaching eye.
   α. Maxillary barbel extending about to anal. Height about 5, head 3—3$^1/_2$ in length . *M. nemurus* p. 341.
   β. Maxillary barbel extending to base of ventrals. Height more than 6, head 3$^3/_4$—4$^1/_4$ in length. . . . . *M. planiceps* p. 342.

b. Upper surface of head smooth . . . . . *M. wycki* p. 343.

III. Adipose fin shorter than anal . . . . . *M. gulio* p. 344.

1. **Macrones nigriceps** (C. V.) [Fig. 145, p. 336].

Bagrus nigriceps Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 412.
Bagrus macronemus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 150.
Bagrus singaringan Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 150.
Bagrus heterurus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 151.
Hypselobagrus macronema Bleeker, Atl. Ichth. II. 1862, p. 58.
Macrones nigriceps Günther, Cat. Brit. Mus. V. 1864, p. 77.
Macrones nigriceps Vaillant, Nouv. Arch. Mus. Hist. Nat. (3) V. 1893, p. 72.
Macrones nigriceps Volz, Revue Suisse Zool. XII. 1904, p. 467.
Hypselobagrus nigriceps Fowler, Proc. Acad. Nat. Sc. Philad. (2) LVII. 1905, p. 470.
Hypselobagrus macronemus Jordan & Seale, Proc. U. S. Nat. Mus. XXXIII. 1908, p. 526.

B. 11; D. II. 7; A. 11—12; P. I. 9—11; V. 6.

Oblong, profile behind dorsal convex, before dorsal strongly sloping down in a straight line to the rounded snout, which is slightly prominent. Head conical, mouthopening slightly curved. Height about equal to head, 4$^1/_2$—4$^3/_4$. Head as broad as high, its greatest width about 1$^1/_3$ in its length, vertex and occipital process granulated, the latter extending to the granulated interspinal bone of dorsal. A median groove ending at base of occipital process. Eye 3—4$^1/_2$. Nasal barbels extending to end of head, maxillary barbels on caudal or to its end, mandibulary barbels reaching ventrals, mental ones on pectoral. Anterior longest rays of dorsal conspicuously longer than head. The osseous part of dorsal spine, slightly serrated at the upper part of its hindborder, about equal to head without snout. Adipose fin very long, contiguous with the dorsal and as high as lowest part of tail. Base of anal more than 4 times in base of adipose fin. Ventrals as long as pectorals, rather

shorter than head. Osseous part of pectoral spine strong, flattened, denticulated behind, as long as or longer than dorsal spine. Villiform teeth in bands, those of the palate and the lower jaw crescent-shaped. Violet greyish, underside lighter, distal part of fins dark. Length 335 mm.

Nomen indig.: Singaringan (Malay. Batavia, Palembang, Djambi); Ririgi (Bantam); Sengat (Benkulen).

Habitat: Java (Batavia, Sunter!, Bekassi!, Tulung agung!, Tjiringin, Buitenzorg!, Perdana, Ambarawa, Kediri!, Surabaya, Pasuruan); Sumatra (Benkulen, Padang, Priaman, Lahat, Palembang!, Gunung Sahilan!, Taluk!, Ringat!, Djambi!, Serdang!, Deli); Borneo (rivers Mahakam!, Barito, Kahajan, Kapuas, Sambas, Baram). — Malacca, Siam.

In rivers and lakes.

Note. *M. cavasius* has been recorded by Cuvier & Valenciennes from Java and by von Martens from Borneo. We are of Bleeker's opinion, that these authors confounded specimens of *M. nigriceps* with *M. cavasius*.

2. Macrones baramensis Reg.

Macrones baramensis C. Tate Regan, Ann. Mag. Nat. Hist. (7) XVIII, 1906, p. 68.

Depth of body $4^2/_3$ in the length, length of head $3^2/_3$. Breadth of head $1^1/_3$ in its length, its depth at occiput less than $^3/_5$ its length, diameter of eye 5. Snout $^1/_3$ the length of head, broad, obtuse, slightly projecting beyond the mouth. Palatine bands of teeth confluent with the small vomerine patch. Nasal barbel nearer to end of snout than to eye, $^1/_2$ the length of head; maxillary barbel extending to the posterior end of the adipose fin. Head covered with smooth skin, the median fontanel extending to base of occipital process; occipital process very long and slender, 8 times as long as broad, extending beneath the skin to the basal shield of the dorsal spine. Clavicular process not reaching the middle of the pectoral spine. Dorsal I, 7, the spine weakly serrated behind, a little more than $^1/_2$ the length of head; anterior branched rays $^3/_4$ the length of head. Adipose fin much longer than base of anal, commencing at a distance from the dorsal, wich is equal to $^2/_7$ the length of its own base, which is equal to its distance from the dorsal spine. Anal 11. Pectoral spine about $^2/_3$ the length of head, with moderately strong serrae on the inner

edge. Ventrals not quite reaching the anal. Caudal forked. Caudal peduncle $1^2/_3$ as long as deep. Brownish, fins dusky. Length 150 mm. [After Regan's description, supplemented and altered by informations by letter].

Habitat: Borneo (Baram river).

3. Macrones micracanthus (Blkr.)

Bagrus micracanthus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2), 1846, p. 151. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 161.
Hypselobagrus micracanthus Bleeker, Atl. Ichth. II. 1862, p. 59.
Macrones micracanthus Günther, Cat. Brit. Mus. V. 1864, p. 76.
Macrones micracanthus Steindachner, Abh. Senckenb. Naturf. Gesellsch. XXV. 1901, p. 446.
Macrones bimaculatus Volz, Revue Suisse de Zool. XII. 1904, p. 466.

B. 9; D. II. 7; A. 11—12; P. I. 8—9; V. 6.

Oblong, dorsal profile elevated before dorsal, head somewhat flattened, snout rounded, slightly prominent. Mouthopening crescentic. Height 4—5, head about 4, its greatest width $1^1/_3$ in its length. A median groove in the anterior half of the head only, the upper surface of head finely rugose, as well as the slender occipital process, which reaches the interspinal bone of the dorsal. Eye $4^1/_2$—5. Nasal barbels reaching frontborder of operculum, maxillary barbels reaching tail or caudal, mandibulary ones end of pectorals, mental ones extending on pectorals. Height of dorsal about $^3/_4$ in head, osseous part of spine less than half of head, serrated behind. Adipose fin much longer than dorsal and anal; more or less contiguous with dorsal by a low anterior part, which may rise gradually, immediately behind dorsal (*bimaculatus* Volz), or forms a low ridge of some extent before rising. These two extremes are connected by transitions and their conspicuousness depends on the kind of preservation. Ventrals shorter than pectorals, which are as long as height of dorsal. The osseous part of their strong flattened spine, with the hindborder strongly serrated, is somewhat shorter, but much longer than dorsal spine. Villiform teeth, in the upper jaw in a slightly, in the lower jaw in a strongly curved band. The crescent-shaped band on the palate narrower than that of the jaws. Violet brown above, lighter below, fins brownish. A more or less conspicuous dark spot at base of caudal, preceded in the young by a white band encircling the caudal peduncle. A round black spot behind

opercle, bordered with white in young specimens. Length 145 mm.

Nomen indig.: Singaringan (Malay. Batavia); Ririgi (Bantam); Keteng (Bekassi); Enting (Kudus); Sengat (Benkulen); Ikan baung (Palembang); Lundu (Djambi).

Habitat: Java (Batavia, Bekassi!, Kudus!, Tjiringin, Perdana, Ambarawa, Kediri, Surabaya, river Brantas, river Mandiku!, Palabuan); Sumatra (Benkulen, Palembang, Padang, Priaman, Lahat, Taluk!, Gunung Sahilan!, Djambi!, Deli!, Djapura, Bagan Api Api!); Borneo (Putus Sibau on river Kapuas!, Prabukarta, rivers Sambas and Baram).

In rivers.

4. **Macrones wolffi** (Blkr.).

Bagrus Wolffii Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 205. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 160.
Hypselobagrus Wolffii Bleeker, Atl. Ichth. II. 1862, p. 58.
Macrones Wolffii Günther, Cat. Brit. Mus. V. 1864, p. 82.
Macrones Wolffii Peters, Monatsber. Akad. Berlin, 1868, p. 271.
Macrones Wolffii Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 171.
Macrones Wolfii Vaillant, Notes Leyden Mus. XXIV. 1902, p. 54.

B. 8—9; D. II. 7; A. 14; P. I. 9; V. 6.

Oblong, profile from dorsal to rounded, prominent snout sloping down in a straight line. Head conical. Mouthopening crescentic. Height 4—4 1/4, head somewhat more, its greatest width about 1 1/3 in its length. A median fontanel, nearly reaching to base of narrow occipital process, which extends to the interspinal bone of dorsal. Surface of head finely rugose. Eye 3 1/2—4 1/2. Nasal barbels longer than head, maxillary barbels reaching caudal, mandibulary barbels extending on anal, mental ones on pectorals. Dorsal fin pointed, its first ray longer than height of body, its strong, flattened spine, with the hindborder serrated, longer than head without snout. Adipose fin about equal to anal and dorsal and to their distance. Ventrals about as long as head without snout, pectorals shorter than head, their strong, flattened spine, with the hindborder strongly denticulated, much longer than dorsal spine. Villiform teeth in curved bands, that of the palate the narrowest. Dark violet, underside whitish. Nasal and maxillary barbels blackish, mandibulary and mental ones whitish. Length 200 mm.

Nomen indig.: Singirian (Malay. Banjermassin), Ikan Lundu (Djambi).

Habitat: Borneo (rivers Mahakam, Barito, Kapuas, Sarawak); Sumatra (Palembang!, Rokan river!, Djambi!). — Malacca, Siam.

In rivers.

5. Macrones nemurus (C. V.).

Bagrus nemurus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 423.
Bagrus Hoevenii Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 154.
Bagrus Sieboldii Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p, 155.
Bagrus nemurus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 150.
Bagrus Hoevenii Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 153.
Hemibagrus nemurus Bleeker, Atl. Ichth. II. 1862, p. 55.
Hemibagrus Hoevenii Bleeker, Atl. Ichth. II. 1862, p. 56.
Macrones nemurus Günther, Cat. Brit. Mus. V. 1864. p. 80.
Macrones nemurus Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 169.
Macrones Hoevenii Vinciguerra, Ann. Mus. Civ. Genova, XVI. 1880, p. 170.
Macrones bleekeri Volz, Zool. Anz. XXVI. 1903, p. 556. — Zool. Jahrb. Abt. Syst. XIX. 1903, p. 387.
Hemibagrus nemurus Fowler, Proc. Acad. Nat. Sci. Philad. (2) LVII. 1905, p. 469.
Macrones howong Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 181. — o. c. XXVII. 1906, p. 32.
Macrones bongan Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 182. — o. c. XXVII. 1906, p. 35.
Macrones bo Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 183. — o. c. XVII. 1906, p. 38.
Macrones kajan Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 184. — o. c. XXVII. 1906, p. 41.
Macrones fortis Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 185. — o. c. XXVII. 1906, p. 44.
Macrones fortis var. capitulum Popta, Notes Leyden Mus. XXIV. Jan. 1904, p. 186. — o. c. XXVII. 1906, p. 48.

B. 11—12; D. II. 7; A. 12—13; P. I. 8—9; V. 6.

Oblong, dorsal profile elevated before dorsal; head flattened, snout spatulate, prominent. Mouthopening crescentic, subterminal. Height about 5, head 3—$3^1/_2$, broader than high, its greatest width about equal to its length without snout. Eye 6—$8^1/_2$, 2 to nearly 3 in snout, which is equal to about $^1/_3$ of the head. Shields of the head striated, rugose, with a median groove ending before the slender occipital process, which is triangular and longer than broad at its striated base. Nasal barbels reaching the eye, maxillary barbels extending to anal or not so far, mandibulary barbels reaching base of pectorals, mental ones conspicuously shorter. Dorsal with the second ray the longest, slightly shorter than head, the osseous part of its spine nearly equal to postorbital part of head, its base longer than that

of the adipose fin and than the distance between both fins. Adipose fin situated above the anal and slightly longer than that fin. Caudal deeply forked, its upper lobe more or less produced. Pectorals about equal to head without snout, their strong, flattened spine, denticulated at its hindborder, is somewhat shorter. Ventrals not extending to anal, originating below posterior dorsal rays, as long as postorbital part of head. Villiform teeth in curved bands, the band on the palate as broad as, or broader than that of the maxillary. Blackish, undersurface white. Fins violet, adipose with a light hindborder, pectorals and ventrals with a reddish base. Length 350 mm. [Types of species of Miss Popta seen by us].

Nomen indig.: Ikan bawon (Malay. Batav.); Singgal, Singah (Sundan.); Tageh (Javan.); Ikan baon (Sarawak); Niken, Siken, Tiken, Tiken bato, Kendija (Central Borneo); Ikan duri, Ikan baung (Sumatra).

Habitat: Java (Batavia, Bekassi!, Krawang, Buitenzorg!, Dukok, Tjibilong, Garut!, Surabaya, Gempol, Grati, Malang, Pasuruan); Sumatra (Palembang!, Benkulen, Moara kompeh, Padang, Solok!, lakes Singkarah! and Manindjau!, Taluk!, Gunung Sahilan!, Kaju tanam!, Banjuasin, Sungi Mahe, Kota Baru, Indragiri, Upper Langkat, Djambi!, Deli!); Banka; Singkep!; Singapore; Borneo (rivers Kajan, Mahakam, Kusan, Barito, Kahajan, Kapuas!, Sambas, Mempawah, Sarawak, Baram). — Malacca, Siam.

In fresh and brackish water.

6. **Macrones planiceps** (C. V.)

Bagrus planiceps Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 421.
Bagrus anisurus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 422.
Bagrus flavus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 156.
Bagrus planiceps Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 154.
Hemibagrus planiceps Bleeker, Atl. Ichth. II. 1862, p. 56.
Macrones planiceps Günther, Cat. Brit. Mus. V. 1864, p. 81.
Macrones planiceps Steindachner, Sitzber. Akad. Wien, LVII. I. 1868, p. 1004.
Hemibagrus planiceps Jordan & Seale, Proc. U. S. Nat. Mus. XXXIII. 1908, p. 536.

B. 11; D. II. 7; A. 14; P. I. 9; V. 6.

Elongate, dorsal profile slightly elevated before dorsal, head flattened, snout spatulate, prominent, mouthopening crescentic, subterminal. Height more than 6, head $3^3/_4$—$4^1/_4$, broader than high, its greatest width about equal to its length without snout. Eye 5—6, $1^3/_4$ in snout, which is equal to about $^1/_3$ of

head. Shields of head nearly smooth, with a superficial median groove reaching nearly to the occipital process, which is covered by skin. Nasal barbels reaching the eye, maxillary barbels the base of the ventrals, mandibulary barbels the base of pectorals, mental ones much shorter. Dorsal equal to head without snout or somewhat longer, the osseous part of its spine is scarcely half as long as head, slightly serrated behind; base of dorsal about equal to its distance from adipose fin, which is situated above anal, slightly longer than that fin and about equal to dorsal. Caudal deeply forked, with the lobes pointed. Ventrals not reaching to anal, situated below posterior rays of dorsal, longer than half head. Pectorals as long as head without snout, their strong, flattened spine, with the hindborder denticulated, somewhat shorter, but much longer than dorsal spine. Villiform teeth in curved bands, the band of the palate as broad as or broader than that of the maxillary. Dark violet, lowersurface whitish, fins violet. Length 335 mm.

Nomen indig.: Bawon, Bawon kuning (Malay. Batavia); Singal (Sundan.).

Habitat: Java (Batavia, Buitenzorg, Parongkalong, Garut!); Sumatra (Telokbetong, Pangabuang, Lahat, Trussan, lake Singkarah!, Indragiri, Upper Langkat, Serdang!, Deli); Borneo (rivers Mahakam, Kapuas, Bongon, Sarawak). — Malacca.

In rivers.

7. Macrones wycki (Blkr.).

Bagrus Wyckii Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 156.
Hemibagrus Wyckii Bleeker, Atl. Ichth. II. 1862, p. 57.
Macrones wyckii Günther, Cat. Brit. Mus. V. 1864, p. 83.

B. 10; D. II. 7; A 13—15; P. I. 11; V. 6.

Oblong, head very broad and flat, snout bluntly rounded, prominent, mouthopening in a smooth curve, head smooth above, occipital process short not extending to the interspinal bone of the dorsal. Height about 5, head $3^2/_5$, much broader than high, its greatest width being contained $1^1/_3$ in its length. Eyes looking upward, 10—11 in head, more than 3 in orbital space and more than 3 in snout, which is slightly less than $^1/_3$ of the head. Nasal barbels nearly reaching the eye, maxillary barbels extending to the dorsal fin or nearly to the adipose fin. Mandibulary barbels nearly reaching hindborder of gillmembranes, mental ones much shorter. Dorsal equal to

postorbital part of head, the osseous part of its strong, flattened spine, which is denticulated along its hindborder, one eye-diameter shorter. Base of dorsal nearly equal to its distance from the adipose fin, the base of which is much longer than anal or dorsal. Ventrals far distant from anal, originating behind dorsal or below its last ray, a little shorter than pectorals, which are very broad and half as long as head. The osseous part of their strong, flat spine has the hindborder denticulated, much shorter than half head and much shorter than dorsal spine. Caudal bifurcated, the lobes pointed, the upper one the longer. Teeth in broad bands, in the upper jaw slightly curved, in the lower jaw strongly so, those on the palate in a horse-shoe like band, as broad as the maxillary one. Violet, underside of head, belly, hindborder of operculum, upperborder of orbit, an interorbital patch, whitish. A yellowish border at upper and lower margin of caudal, at anterior margin of adipose fin and anal and ventrals. Length 450 mm.

Nomen indig.: Hinur (Sundan.), Ikan Djatisa (Djambi).

Habitat: Java (river Tjitarum); Sumatra (river Batang Hari!). In rivers.

8. **Macrones gulio** (Ham. Buch.).

Pimelodus gulio Hamilton Buchanan, Fishes of the Ganges, 1822, p. 201.
Bagrus albilabris Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 416.
Bagrus fuscus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 417.
Bagrus gulio Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 418.
Bagrus birmannus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 419.
Bagrus abbreviatus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 420.
Bagrus gulioides Bleeker, Nat. & Geneesk. Arch. Ned. Indië, III (2). 1846, p. 152.
Bagrus melas Bleeker, Nat. & Geneesk. Arch. Ned. Indië, III (2). 1846, p. 152.
Bagrus Schlegelii Bleeker, Nat. & Geneesk. Arch. Ned. Indië, III (2). 1846, p. 153.
Bagrus rhodopterygius Bleeker, Nat. & Geneesk. Arch. Ned. Indië, III (2). 1846, p. 153.
Bagrus abbreviatus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1236.
Bagrus gulio Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 163.
Aspidobagrus gulio Bleeker, Atl. Ichth. II. 1862, p. 60.
Macrones gulio Günther, Cat. Brit. Mus. V. 1864, p. 79.
Macrones gulio Kner, Novara-Exp. Fische, 1865—1867, p. 307.
Macrones gulio Day, Fishes of India 4°. 1878—1888, p. 445.

B. 9; D. I. 7; A. 14—15; P. I. 8—9; V. 6.

Elongate, rather robust. Height $4^1/_4$—$4^1/_3$, head $3^1/_2$—$3^2/_3$. Greatest width of head somewhat more than head without snout. Dorsal profile before dorsal sloping downwards in a

straight line to the broad snout, which is slightly prominent and equal to about $^1/_3$ the length of the head and about twice as long as the eye. Interorbital space flattened, 2—3 times the diameter of the eye. Upper surface of head granulate, occipital process triangular, very narrow, separated or nearly separated by a cutaneous interspace from the long, prominent basal bone of the dorsal spine. Median groove very short, extending about to the vertical through the hindborder of the eye. Nasal barbels reaching to hindborder of eye or somewhat farther, maxillary ones to the anal, mandibulary ones half way on pectorals, mental ones about half their length shorter. Height of dorsal equal to head without snout, its flattened spine serrated behind, equal to postorbital part of head. Base of adipose fin rather shorter than that of the dorsal, its length being less than one half of the distance between both fins. Anal rounded, its highest rays longer than postorbital part of head. Ventrals broadly rounded, inserted behind dorsal, reaching to anal. Pectorals equal to head without snout. The strong and flattened pectoral spine is as long as head without snout, about $^1/_4$ longer than dorsal spine, its hindborder strongly denticulated. Caudal deeply forked, the lower lobes shorter and rounded. A crescentic vomero-palatine band of villiform teeth, equal to that on the jaws. Greyish brown, undersides of head and body whitish. Nasal and maxillary barbels and distal part of fins blackish. Length 450 mm.

Nomen indig.: Lundu, Manjong lundu (Malay. Batavia); Geting (Javan.); Senkiran (Madura).

Habitat: Java (Batavia!, Bantam, Cheribon, Surabaya!, Pasuruan); Madura; Sumatra (Padang, Palembang); Borneo (Banjermassin). — Pinang, Malacca, Burma to British India and Ceylon.

In sea, estuaries and tidal rivers.

2. **Bagrichthys** Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 130).

Rather elongate, much compressed; nape and base of dorsal much elevated. Head conical; snout blunt, prominent before the transverse, rather small mouthopening, with thick lips. Skin covers the eyes and conceales more or less the occipital process, which touches the prolonged, somewhat carinate basal bone of dorsal spine. Anterior nostrils tubular, in the frontpart of the snout. Posterior nostrils valvulate, near eye. 8 barbels, the

mandibulary and mental ones in two pairs, separated by two mental pores and two pores above each pair. A short, high dorsal, with a long pungent spine, the teeth at the hindborder of which are directed upward; at a short distance followed by a very long, convex adipose fin, totally adnate to the body. Anal short, opposed to middle of the adipose fin. Pectorals with a pungent spine. Caudal deeply forked, with the lobes more or less produced into filaments. Villiform teeth in bands in the jaws and on the vomer, besides long movable labial teeth in the lower jaw. Gillmembranes totally united, free from isthmus, their hindborder with a slight notch behind. Branchiostegals 7.

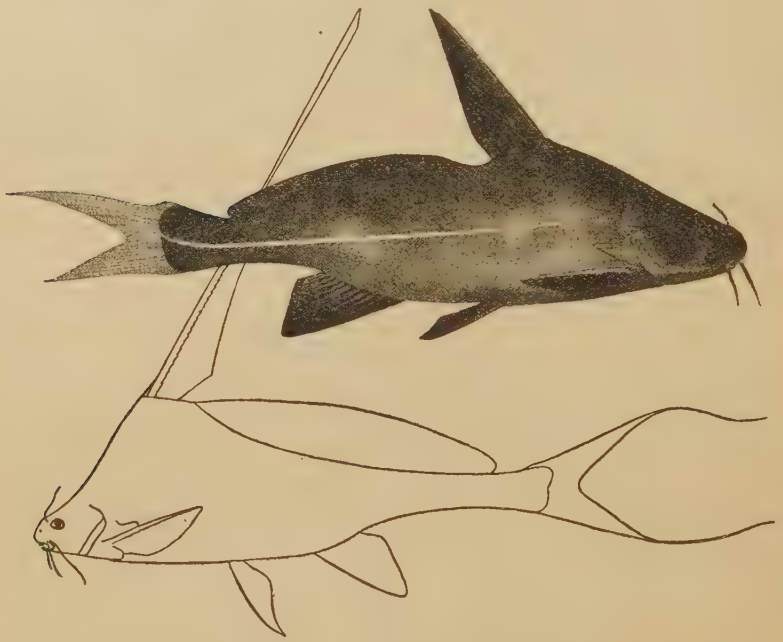

Fig. 146. *Bagrichthys hypselopterus* Blkr.
The figure in outline represents a fullgrown specimen after Bleeker.

1. Bagrichthys hypselopterus (Blkr.).

Bagrus hypselopterus Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 588.
Bagrichthys hypselopterus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 131. — Atl. Ichth. II. 1862, p. 49.
Bagrichthys hypselopterus Günther, Cat. Brit. Mus. V. 1864, p. 92.

B. 7; D. I. 7; A. 15; P. I. 10—11; V. 6.

Height below dorsal spine $3^1/_4$—$3^4/_5$, head 5—7, eye 5—8. Barbels shorter than head, longer and broadened in the males. Dorsal acute, its first ray much longer than height of body, its flattened spine still higher, according to age. Adipose fin contiguous to dorsal and more than 4 times longer than it. Pectoral spine strong, its hindborder conspicuously serrated, shorter or somewhat longer than head. Darkish brown, belly, a dorso-ventral and a dorso-anal band lighter. Lateral line a narrow white band. Caudal and posterior end of adipose fin yellowish. Length more than 400 mm.

Nomen indig.: Ikan lalajang (Djambi).

Habitat: Sumatra (Palembang, Rokan river!, Djambi!); Borneo (Sintang) [1]).

In rivers.

3. **Bagroides** Bleeker.

(Bleeker, Nat. Tijdschr. Ned. Indië, II. 1851, p. 204).

More or less elongate and robust. Head covered by thick skin, snout conical, prominent, mouthopening rather small, transverse, with thick lips. Occipital process touching the basal bone of the dorsal spine. Eye covered by skin. 8 barbels. Short dorsal with a strong pungent spine, its hindborder with teeth directed upward. A long or very long adipose fin, totally adnate to the back or with the hindborder free. Origin of ventrals before or below origin of adipose fin. Anal with less than 20 rays. Pectorals with a strong pungent spine, serrated behind. Caudal deeply forked. Small teeth in more or less curved bands in the jaws, on the vomer in a curved band or in a semioval patch. Gillmembranes totally united, free from isthmus, with or without a shallow notch behind. Branchiostegals 7—8.

Synopsis of the species.

1. Adipose fin about as long as the head; vomerine teeth in a semioval patch (*Bagroides* Blkr.) . . . . . *B. melapterus* p. 348.
2. Adipose fin twice as long as the head; vomerine teeth in a short, curved, uninterrupted band (*Pseudobagrichthys* Blkr.).

1) The locality „China" (Karoli Janos, Termeszetrajzi füzetek, V. 1882, p. 32) is probably erroneous.

a. Dorsal spine about as long as head, about equal to pectoral spine; width of mouth about equal to eye *B. macropterus* p. 349.

b. Dorsal spine much longer than head and than pectoral spine; width of mouth much less than twice the diameter of eye. . . . . *B. macracanthus* p. 350.

1. Bagroides melapterus Blkr.

Bagroides melapterus Bleeker, Nat. Tijdschr. Ned. Indië, II. 1851, p. 204.
Bagroides melanopterus Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 413. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 134. — Atl. Ichth. II. 1862, p. 51.
Bagroides melanopterus Günther, Cat. Brit. Mus. V. 1864, p. 90.

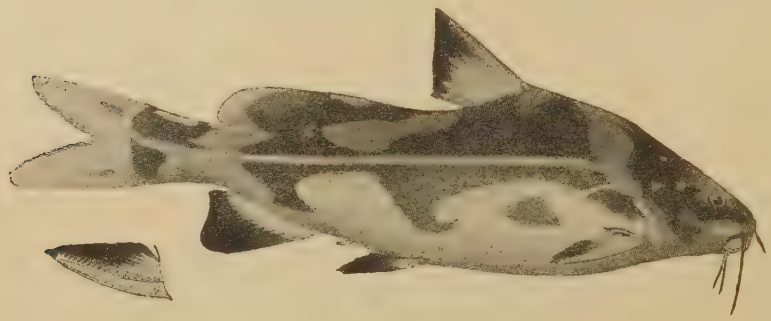

Fig. 147. *Bagroides melapterus* Blkr. and upper view of pectoral fin.

B. 7—8; D. I. 7; A. 16—17; P. I. 9; V. 6.

Robust, rather short, covered by velvety skin. Dorsal profile of head convex, ascending steeply to the dorsal. Height $3^4/_5$—4; head $4^1/_2$ to nearly 5, as high as broad, somewhat pointed anteriorly, covered by thick skin, less thick on occipital process, which is about thrice as long as broad at its base, only slightly tapering behind, its rounded posterior extremity touching the basal bone of the dorsal spine. Eye 5—6, situated at the end of the anterior half of the head, about $1^1/_2$ times in the thick, prominent snout or in the interorbital space. Lips very thick. Nasal barbels reaching on opercle, maxillary barbels on base of pectorals, mandibulary and mental ones shorter. Height of dorsal and its strong, flattened spine, the hindborder of which has strong teeth directed upwards, about equal to head. Adipose fin with free hindborder, its base about twice as long as that of dorsal, the distance between both equals the length of the dorsal. Anal lower than dorsal, its origin in the vertical through the end of the first $^1/_3$ of the adipose fin. Ventrals not reaching

anal, their origin behind the end of the dorsal. The strong, flat pectoral spine, with the hindborder strongly serrated, about equal to that of the dorsal. Caudal deeply forked, with pointed lobes. Small teeth in the upper jaw in a quadrangular or oval patch, twice as broad as long, those in the lower jaw in a semioval patch. Yellowish. Large, irregular, partly anastomosing black patches on the top of the head, before and below the dorsal and adipose fin and on the tail. Lateral line yellowish. Fins yellow, distally black. Length 340 mm.

Nomen indig.: Ikan radja meno (Indragiri), Ikan tetus tetus (Djambi).

Habitat: Sumatra (Palembang!, river Kwantang, Indragiri, Djambi!); Borneo (rivers Barito, Kahajan, Kapuas!, Sambas, Rajang). — Siam.

In rivers.

2. **Bagroides macropterus** Blkr.

Bagroides macropterus Bleeker, Nat. Tijdschr. Ned. Indië, V. 1853, p. 515. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 136.
Pseudobagrichthys macropterus Bleeker, Atl. Ichth. II. 1862, p. 50.
Bagroides macropterus Günther, Cat. Brit. Mus. V. 1864, p. 91.

B. 7; D. I. 7; A. 14—15; P. I. 9; V. 6.

Elongate, compressed. Height about 5; head about 6, conical, convex, acute, longer than high and broad. Occipital process slender, about thrice longer than broad at its base, convex, its slender point touching the elongate, smooth or rugose basal bone of the dorsal spine. Eyes about 5, $1^1/_3$ or $1^1/_4$ distant. Snout less than twice longer than eye, very convex, compressed, prominent, acutely rounded. Width of mouth about equal to eye. Lips fleshy. Barbels slender, the nasal ones reaching on postocular part of head, the maxillary ones on opercle or humeral bone, the mandibulary ones to branchial opening, the mental ones still shorter. Height of dorsal about equal to height of body, about twice its length; its spine moderate, slightly or not longer than head, its hindborder with moderate teeth, directed upward. Adipose fin not free behind but adnate to the body, beginning very close to dorsal, and more than 4 times longer than that fin. Anal convex, lower than body, opposite to median part of adipose fin, more than thrice or 4 times longer than that fin. Pectoral spine stronger and not longer or slightly longer than the dorsal one. Caudal deeply forked, its lobes

acute. Small teeth in the jaws in a short, slightly curved band, those on the vomer in a small subsemilunar patch. Brownish with a diffuse irregular cephalic, dorso-ventral, dorso-anal and caudal cross band. Fins, with exception of the adipose and caudal fin, blackish in their distal half. Length 256 mm. [After Bleeker; not seen by us].

Habitat: Sumatra (Palembang, Muara kompeh). — Siam. In fresh water.

3. Bagroides macracanthus Blkr.

Bagroides macracanthus Bleeker, Nat. Tijdschr. Ned. Indië, VII. 1854, p. 88. — Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 137.
Pseudobagrichthys macracanthus Bleeker, Atl. Ichth. II. 1862, p. 50.
Bagroides macracanthus Günther, Cat. Brit. Mus. V. 1864, p. 91.
? *Leiocassis macropterus* Vaillant, Notes Leyden Museum, XXIV, n°. 1–3, 1902, p. 58.
Bagroides macracanthus Volz, Revue Suisse Zool. XII. 1904, p. 469.
? *Bagroides Vaillantii* Popta, Notes Leyden Museum, XXVII. 1906, p. 228, footnote.

B. 7; D. I. 7; A. 14—15; P. I. 9; V. 6.

Elongate, compressed. Height about 4; head about $5^1/_2$, conical, acute, convex, longer than high and broad. Occipital process about thrice longer than broad at its base, straight, its slender end touching the much elongated slender smooth basal bone of dorsal spine. Eyes about $4^2/_3$, somewhat more than one eyediameter apart. Snout less than twice longer than eye, strongly convex and rounded, prominent. Lips fleshy. Width of mouth much less than twice the diameter of the eye. Six conspicuous mental pores in two rows, the anterior row consisting of two. Barbels slender, the nasal ones reaching to posterior part of eye, the maxillary ones to operculum, the mandibulary ones to branchial opening, the mental ones still shorter. Height of dorsal slightly more than that of body, double its base. Its spine moderate, much longer than head, its hindborder with strong teeth directed upward. Adipose fin not free behind, but adnate at the back, commencing at a very short distance from the dorsal and more than 4 times longer than it. Anal convex, lower than body, opposed to middle of adipose fin and 4 times shorter than it. Pectoral spine not stronger than the dorsal one, but much shorter, its hindborder strongly serrated. Caudal deeply forked, its lobes acute. The teeth in upper jaw and on vomer in a subsemilunar band, those in the lower jaw obtuse, conical, the outer

series larger. Brownish, with a diffuse irregular cephalic, dorso-anal and caudal cross band. Fins brownish. Length 240 mm. [After Bleeker, not seen by us].

Habitat: Sumatra (river Enim, river Si Russu, Djapura); ? Borneo (Mahakam river: *Leiocassis macropterus* Vaillant).

In rivers.

4. Leiocassis Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I Siluri, 1858, p. 139).

More or less elongate and robust. Head more or less flattened above, covered by skin or headshields naked. Occipital process touching the basal bone of dorsal spine, or free from it, or both united by a separate shield. Snout more or less prominent, above the slightly curved mouth. Eye covered by skin. 8 barbels. Dorsal short, its pungent spine with the hindborder smooth or weakly or strongly serrated, the teeth directed downward. Adipose fin as long as or longer than dorsal, opposite to anal, which has less than 20 rays. Pectorals with a strong spine, conspicuously denticulated behind. Caudal deeply bifurcate. Anal with less than 20 rays. Villiform teeth in curved bands in the jaws and on the palate. Gillmembranes nearly totally separated, free from isthmus. Branchiostegals 9—11.

Synopsis of the species [1]).

I. Head covered with smooth skin.

A. Dorsal spine less than $^1/_3$ length of head; maxillary barbel reaching pectoral.

1. Depth of body 5 in the length . . . . . *L. fuscus* p. 353.
2. Depth of body 6 in the length . . . . . *L. mahakamensis* p. 354.

B. Dorsal spine at least $^2/_3$ length of head.

1. Maxillary barbel reaching pectoral; head nearly as broad as long . . . . . *L. stenomus* p. 355.
2. Maxillary barbel not extending beyond head, which is longer than broad.
   a. Occipital process reaching basal shield of dorsal spine . . . . . *L. poecilopterus* p. 356.
   b. Occipital process not reaching basal shield of dorsal spine.

1) After Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 548.

aa. Vomerine band of teeth without or with a very short and blunt median posterior process.

α. Caudal peduncle about twice as long as deep.

1. Occipital process not longer than eye, less than its distance from basal bone of dorsal spine. . . . *L. micropogon* p. 357.

2. Occipital process a little longer than eye, as long as its distance from basal bone of dorsal spine. *L. saravacensis* p. 358.

3. Occipital process $1^1/_2$ to 2 as long as eye, 2 to $2^1/_2$ as long as its distance from basal bone of dorsal spine; head $1^1/_2$ as long as broad. . . . . *L. baramensis* p. 358.

4. Occipital process more than twice as long as eye, 4 times as long as its distance from basal bone of dorsal spine; head $1^2/_3$ as long as broad. . . . . *L. merabensis* p. 359.

β. Caudal peduncle $2^1/_2$ to $2^3/_4$ as long as deep . . . . . *L. hosii* p. 360.

bb. Vomerine band of teeth with a strong median posterior projection. . . . . *L. doriae* p. 360.

II. Upper surface of postorbital part of head naked, rugose; occipital process meeting basal shield of dorsal spine; snout scarcely projecting beyond mouth; teeth on palate forming a curved band without median posterior projection.

A. Supraclavicular plate small, not produced backwards, its lower edge in contact with basal part of clavicular process.

1. Head nearly as broad as long; pectoral spine as long as head . . . . . *L. breviceps* p. 361.

2. Head longer than broad; pectoral spine shorter than head.

a. Depth of body $5^1/_2$ to 7 in the length; caudal peduncle $2^1/_2$ as long as deep.

α. Bony area of upper surface of head with straight anterior edge; occipital process longer than broad; ventrals reaching anal; fins immaculate . . . . . *L. inornatus* p. 362.

β. Bony area of upper surface of head with emarginate anterior edge; occipital process broader than long; ventrals not nearly reaching anal; dorsal and anal with dark bars. . . . . *L. vaillanti* p. 362.

b. Depth of body $4^1/_2$ in the length; caudal penduncle $1^3/_4$ as long as deep. . . . . *L. rugosus* p. 363.

B. Supraclavicular plate produced backwards into a pointed process.

1. Supraclavicular process small, not extending so far back as clavicular process . . . . . *L. leiacanthus* p. 364.

2. Supraclavicular process strong, extending as far back as clavicular process . . . . . *L. moeschi* p. 364.

Fig. 148. *Leiocassis leiacanthus* M. Web. & de Bfrt.

1. Leiocassis fuscus Popta.

Liocassis fuscus Popta, Notes Leyden Mus. XXIV. 1903, p. 168. — ibid. XXVII. 1906, p. 52.

D. I. 7; A. 13; P. I. 6; V. 6.

Height 5, head 4, its depth $1^2/_3$, its width $1^1/_3$ in its length. Head covered by smooth skin. Eye 10, situated in the anterior half of the head, $3^1/_2$ times in the interorbital space, 3 times in the slightly prominent snout. Nasal barbels 5 times longer than eye, reaching on last half of head. Maxillary barbels extending on and mandibulary barbels to pectorals, mental barbels half as long. Height of dorsal less than that of body, its weak spine less than $^1/_3$ of the length of the head, its hindborder without

serrations. Base of adipose fin equal to that of the dorsal, the distance between them is twice that length. Pectoral spine strongly denticulated posteriorly and less so anteriorly, twice as long as the dorsal one. Ventrals not reaching anal, their origin immediately behind the vertical through end of base of dorsal. Origin of anal before vertical through origin of adipose fin. Caudal deeply bifurcate. Least height of caudal peduncle $1^3/_4$ times in its length. The bands of teeth in the jaws and on the palate are equally narrow. Blackish brown, lighter below. A light cross band from nape downward and lighter patches on the sides behind dorsal and adipose fin. Dorsal with a dark submarginal band. Adipose fin blackish with a light hindborder. Other fins lighter with dark bands or patches. Length of single specimen known 51 mm. (Type in Leyden Museum seen by us).

Nomen indig.: Baung Bebang.

Habitat: Borneo (Upper Mahakam river!).

2. Leiocassis mahakamensis Vaill.

Leiocassis mahakamensis Vaillant, Notes Leyden Mus. XXIV. (n°. 1—3), 1902, p. 55.

D. II. 6; A. 16; P. I. 7; V. 6.

Head depressed, covered by soft skin. Height 6, head $3^2/_3$, eye about 8, shorter than the short, obtuse snout, slightly prominent, the length of which is equal to the interorbital space and $^2/_7$ of the length of the head. Occipital process short, pointed, triangular, certainly not reaching the basal bone of the dorsal spine. Barbels rather long, the nasal barbels nearly reaching end of head, the maxillary ones nearly reaching to the extremity of the pectoral spine, mandibulary barbels reaching on pectorals, mental ones shorter. Dorsal spine short, $^2/_7$ of the length of the head. Adipose fin $^1/_4$ longer than the dorsal, the distance between both longer than the adipose fin. Caudal deeply forked, especially the upper lobe prolonged. Anal beginning opposite to adipose fin. Pectoral spine strong, strongly denticulated at both edges, about equal to head without snout. Ventrals far behind end of dorsal, about equal to postorbital part of head. Palatine teeth in a semicircular band. Upper surface of head and body bluish black, ventral surface white, with a rufous hue, along each side a narrow whitish band, running from behind the opercle to base of

caudal. Adipose fin and caudal bordered by the same colour. Pectorals, ventrals and anal hyaline, lastnamed with a transverse series of black spots. Dorsal hyaline, sometimes with a black submarginal band. Length about 120 mm. [Type in Leyden Museum seen by us].

Habitat: Borneo (Mahakam river!).

3. Leiocassis stenomus (C. V.).

Bagrus stenomus Cuvier & Valenciennes, Hist. Nat. Poissons, XIV. 1839, p. 415.
Leiocassis Ellenriederi Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Negende Bijdrage Sumatra, p. 10.
Leiocassis stenomus Bleeker, Atl. Ichth. II. 1862, p. 54.
Liocassis stenomus Günther, Cat. Brit. Mus. V. 1864, p. 90.
Liocassis stenomus Vaillant, Nouv. Arch. Mus. Hist. Nat. (3) V. 1893, p. 73.
Liocassis stenomus Popta, Notes Leyden Museum, XXVII. 1906, p. 51.

B. 9; D. I. 7; A. 15—17; P. I. 7; V. 6.

Dorsal profile nearly straight from snout to dorsal. Height $4^2/_3$ to nearly 6. Head 4—$4^2/_3$, broader than high, covered by skin. Occipital process triangular, short, about as long as broad at its base, reaching or nearly reaching the triangular basal bone of dorsal spine. Eye 4—6, nearly twice in the rounded, prominent snout, which is about equal to interorbital space. Nasal barbels reaching beyond eye or even to hindborder of operculum, maxillary and mandibulary ones extending to end of pectorals or of humeral process, mental ones to humeral process or not so far. Height of dorsal equal to head without snout or a little more, its spine equal to or more than postorbital part of head, with the hindborder weakly serrated. Base of adipose fin longer than that of dorsal, the distance between both is about equal to $1^1/_2$ times the length of the adipose fin. Origin of anal slightly before that of the adipose fin. Origin of ventrals, which are far distant from the anal, behind the end of the base of the dosal. Pectoral spine slightly shorter than the head, with strong denticulations along its hindborder. Caudal deeply forked, with the lobes produced into filaments. Height of caudal peduncle nearly $1^1/_2$ times in its own length. Teeth in jaws and on palate in curved bands. Darkish brown above, lighter below, with lighter cross-bands. A narrow one on occiput, a broader one before adipose fin and a narrow one at caudal peduncle. Dorsal with a black intramarginal band. Adipose fin darkish with a light

margin, other fins brownish. Length 120 mm. [Type and specimens of Bleeker's collection in the Leyden Museum seen by us].

Nomen indig.: Tengkrian (Mahakam).

Habitat: Java; Sumatra (Palembang!, Djambi!, Lahat); Borneo (rivers Kapuas, Mahakam, Seminis). — Malacca.

In rivers.

4. Leiocassis poecilopterus (C. V.).

Bagrus poecilopterus Cuvier & Valenciennes, Hist. Nat. Poissons XIV. 1839, p. 431.
Leiocassis poecilopterus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 140. — Atl. Ichth. II. 1862, p. 53.
Liocassis poecilopterus Günther, Cat. Brit. Mus. V. 1864, p. 89.

B. 10—11; D. I. 7; A. 15—16; P. I. 7—8; V. 6.

Rather robust, dorsal profile of head straight, slightly convex behind head to dorsal. Height $3^2/_5$—4, head $3^2/_5$—$3^2/_3$, covered by soft skin, its height equal to its breadth but much less than its length, concealing the narrow, triangular occipital process, which is about twice as long as broad at its base, touching the narrow, prolonged, triangular basal bone of the dorsal spine. Eye nearly 6, situated at the end of the anterior half of the head, more than twice in the prominent, conical snout, which is much longer than the interorbital space. Barbels very slender. Nasal barbels reaching to middle of eye, maxillary barbels to hindborder of eye, mandibulary barbels shorter, mental ones still shorter. Height of dorsal $^2/_3$ of head, its strong spine equal to head without snout, strongly denticulated behind. Base of adipose fin about $^1/_4$ longer than that of dorsal, its distance from dorsal nearly equal to its own length. Height of the rounded anal slightly less than that of the dorsal, its origin before that of adipose fin. The very strong pectoral spine scarcely longer than the dorsal one, strongly denticulated behind. Ventrals not reaching anal, their origin somewhat behind end of dorsal. Caudal deeply forked, its lobes rounded. Least height of caudal peduncle about $1^1/_2$ times in its length. Teeth in upper jaw in a nearly straight, rather broad band, in the lower jaw and on the palate in a strongly curved band. Darkish brown, lighter below. An occipital and a dorso-ventral irregular lighter crossband as well as one on the caudal peduncle. Fins with dark bands. Length over 180 mm.

Nomen indig.: Klasŏ (Bongan).

Habitat: Java (Batavia!, Buitenzorg); Sumatra (Solok!, Djapura, Laut Tador, Indragiri, Upper Langkat, Deli); Borneo (rivers Kapuas, Bongan, Bongon, Merabeh, Sarawak). — Siam.

In rivers.

5. Leiocassis micropogon (Blkr.).

Bagrus micropogon Bleeker, Nat. Tijdschr. Ned. Indië, III. 1852, p. 94.
Bagrus poecilopterus Bleeker, Nat. Tijdschr. Ned. Indië, V, 1853, p. 445 (nec. C. V.).
Leiocassis micropogon Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 142. — Atl. Ichth. II. 1862, p. 53.
Liocassis micropogon Günther, Cat. Brit. Mus. V. 1864, p. 89.
Liocassis micropogon Vinciguerra, Ann. Mus. Civ. Genova XVI. 1880, p. 171.
Liocassis micropogon C. Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 548.

B. 9—10; D. I. 7; A. 15—16; P. I. 8; V. 6.

Height $5^1/_2$—6; head $3^2/_5$—$3^3/_4$, rather broader than high, its depth being one half of its length, covered with soft skin. Occipital process about as long as eye, its distance from basal bone of dorsal spine much more than its own length. Eye 6—8, according to age more or less than 2 times in the prominent, convex snout, which is longer than the interorbital space. Barbels variable in length, the nasal ones reaching to eye or farther, the maxillary ones to eye or operculum, the mandibulary ones shorter, the mental ones still shorter. Height of dorsal not or scarcely more than height of body, its spine, the hindborder of which is weakly serrated, $1^2/_3$—2 in head. Adipose fin more than twice as long as dorsal, the distance between both is more than half the length of the adipose fin. Base of rounded anal shorter than that of adipose fin. Pectoral spine slightly longer or shorter than that of dorsal, strongly serrated behind. Caudal deeply forked. Maxillary teeth in a slightly curved band, that of the palate and lower jaw strongly curved. Brownish, with irregular dark cross-bands; a brown lateral band running from the head to the caudal; fins with one or two brown bands. Length to about 200 mm. [Typical specimens of Bleeker's collection in the Leyden Museum seen by us].

Nomen indig.: Ikan tugok (Sarawak).

Habitat: Sumatra (Palembang, Lahat, River Kwantan and Mahé, Upper Langkat, Deli); Banka; Biliton; Borneo (River Kapuas, Sambas, Sarawak). — Malacca.

In rivers.

6. Leiocassis saravacensis Boul.

Liocassis saravacensis Boulenger, Ann. Mag. Nat. Hist. (6) XIII. 1894, p. 246.
Liocassis saravacensis C. Tate Regan. Ann. Mag. Nat. Hist. (8) XI. 1913, p. 548.

Depth of body $4^1/_2$ to 5 times in total length, length of head 4 times. Head $1^1/_2$ as long as broad; snout rounded, strongly projecting beyond the mouth; head covered with skin; occipital process not reaching the basal shield of the dorsal spine; diameter of eye 7 times in length of head, interorbital width 4 times; barbels very short, the maxillary reaching the eye. Vomerine teeth in a curved uninterrupted band, without posterior median process. Dorsal I. 6; spine strongly serrated behind, $^2/_3$ length of head. Adipose fin nearly twice as long as dorsal, a little longer than its distance from the latter. Anal 14—15. Pectoral spine $^3/_5$ length of head, strongly serrated on the inner edge. Dark brown, with some large pale brown spots on the sides, and a pale brown bar across the nape; dorsal whitish, with a blackish band in its upper half; adipose fin with a broad whitish edge; ventrals, anal, and caudal whitish. Length of single known specimen 150 mm. [After Boulenger, not seen by us].

Habitat: Borneo (Senah, Sarawak).

7. Leiocassis baramensis Reg.

Liocassis baramensis C. Tate Regan, Ann. Mag. Nat. Hist. (7) XVIII, 1906, p. 67. — Ann. Mag. Nat. Hist. (8) XI. 1913, p. 548.

Depth of body $4^2/_5$ in the length, length of head $3^3/_5$. Head $1^3/_5$ as long as broad. Diameter of eye 9 in the length of head. Snout obtusely pointed, a little more than $^1/_3$ the length of head, projecting beyond the mouth. Nasal barbel nearer to eye than to tip of snout, when laid back not reaching the eye; maxillary barbel $^1/_3$ the length of head, extending to below the eye; head covered with smooth skin; occipital process twice as long as broad, separated by an interspace equal to $^1/_2$ its length from the basal shield of the dorsal spine; clavicular process extending to the middle of the pectoral spine. Vomerine teeth in a curved uninterrupted band, with the median posterior projection rudimentary. Dorsal I. 7; spine feebly serrated behind, $^1/_2$ the length of head. Adipose fin $1^3/_4$ as long as the base of the dorsal and greater than

its distance from the latter. Anal 14. Pectoral spine a little more than $^1/_2$ the length of head, with 23 serrae on its inner edge. Ventrals nearly reaching the origin of anal. Caudal forked. Least depth of caudal peduncle $1^5/_6$ in the distance from the base of last anal ray to that of the middle caudal rays, which is $5^3/_5$ in the length of the fish. Brownish, with 2 oblong pale areas on each side of the posterior part of the body above the lateral line, the second small and well-separated from the first; similar pale areas below the lateral line are confluent and the anterior meets that of the other side in front of the anal fin; fins more or less blackish at the base and with blackish intramarginal bands. Length of single specimen known 190 mm. [After Regan, not seen by us].

Habitat: Borneo (Baram river).

8. **Leiocassis merabensis** Reg.

Liocassis poecilopterus Boulenger, Ann. Mag. Nat. Hist. (6) XIII. 1894, p. 247 (nec. C. V.).

Liocassis merabensis Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 550.

Depth of body $4^2/_3$ to 5 in the length, length of head $3^3/_5$ to $3^2/_3$. Breadth of head $1^2/_3$ in its length, diameter of eye 8 or 9, interorbital width $5^1/_2$. Head covered with smooth skin. Snout moderately broad, rounded, projecting a little beyond the mouth; nasal barbel nearer eye than end of snout, when laid back nearly reaching eye; maxillary barbel extending to middle or posterior edge of eye; occipital process three times as long as broad, separated by a space equal to $^1/_4$ its own length from basal shield of dorsal spine; clavicular process not extending beyond middle of pectoral spine. Vomerine teeth in a curved uninterrupted band, nearly as broad as that of the praemaxillaries, without or with a very short and blunt median posterior process. Dorsal I. 7; spine very feebly serrated behind, about $^1/_2$ the length of head; adipose fin $1^2/_3$ or $1^3/_4$ as long as dorsal, longer than its distance from latter. Anal 14. Pectoral spine from a little more than $^1/_2$ to $^3/_5$ the length of head; inner edge strongly serrated. Ventrals not quite reaching anal. Caudal forked. Caudal peduncle twice as long as deep. Brownish; head with small dark spots; above the lateral line two elongate oval pale yellow areas, the anterior extending to below the adipose fin, the posterior commencing

near end of that fin; larger pale areas below lateral line are confluent below; fins with blackish basal and intramarginal bands. Length 150 mm. [After Regan, not seen by us].

Habitat: North Borneo (Merabeh).

9. Leiocassis hosii Reg.

Liocassis Hosii C. Tate Regan, Ann. Mag. Nat. Hist. (7) XVIII. 1906, p. 67. — Ann. Mag. Nat. Hist. (8) XI. 1913, p. 548.

Depth of body about 5 in the length, length of head 3—$3^1/_2$. Head $1^3/_4$ or $1^4/_5$ as long as broad. Diameter of eye 7—$9^1/_2$ in the length of head. Snout obtusely pointed, $^1/_3$ the length of head, projecting beyond the mouth. Nasal barbel nearer to eye than to tip of snout, when laid back extending to the eye; maxillary barbel $^3/_8$ to $^1/_2$ the length of head, extending beyond the eye; head covered with smooth skin; occipital process about twice as long as broad, separated by an interspace which is less than its own length from the basal shield of the dorsal spine; clavicular process extending to the middle of the pectoral spine. Vomerine teeth in a curved uninterrupted band, with the median posterior projection rudimentary or wanting. Dorsal I. 7; spine feebly serrated behind, about $^1/_2$ the length of head. Adipose fin $1^1/_2$—2 as long as the base of dorsal and equal to or greater than its distance from the latter. Anal 13—16. Pectoral spine about $^1/_2$ the length of head, with 16—21 serrae on its inner edge. Ventrals nearly or quite reaching the origin of anal. Caudal forked. Least depth of caudal peduncle $2^1/_2$—$2^3/_4$ in its length. Brownish; on each side 2 or 3 oblong pale areas both above and below the lateral line; fins blackish at the base and with blackish marginal or intramarginal bands; caudal, in addition, with a blackish spot on each lobe. Length of known specimens to 170 mm. [After Regan, not seen by us].

Habitat: Borneo (Sibu).

10. Leiocassis doriae Reg.

Liocassis doriae C. Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 551.

Depth of body $4^4/_5$ in the length, length of head $3^1/_2$. Breadth of head $1^2/_3$ in its length, diameter of eye 8, interorbital width 5. Head covered with smooth skin. Snout moderately broad,

obtusely pointed, $^1/_3$ the length of head, projecting beyond the mouth; nasal barbel a little nearer to eye than to tip of snout, when laid back not quite reaching the eye; maxillary barbel extending to below the eye; occipital process three times as long as broad, separated by an interspace a little less than its own length from the basal shield of the dorsal spine; clavicular process extending to the middle of the pectoral spine. Vomerine teeth in a curved uninterrupted band, with a pointed median posterior projection, extending back nearly as far as the lateral horns. Dorsal I. 7; spine very feebly serrated behind, nearly $^1/_2$ the length of head. Adipose fin $1^2/_3$ as long as the base of the dorsal and equal to its distance from the latter. Anal 14. Pectoral spine a little more than $^1/_2$ the length of head; inner edge strongly serrated. Ventrals not quite reaching the origin of anal. Caudal forked. Caudal peduncle $2^1/_4$ as long as deep. Brownish, with two oblong pale areas, which may be confluent, on each side of the posterior part of the body above the lateral line; similar pale areas below the lateral line, confluent and meeting in the mid-ventral line; fins with blackish basal and intramarginal bands. Length of single specimen 190 mm. [After Regan, not seen by us].

Habitat: Borneo.

11. Leiocassis breviceps Reg.

Liocassis breviceps C. Tate Regan. Ann. Mag. Nat. Hist. (8) XI. 1913, p. 551.

Depth of body $4^2/_3$—$5^1/_3$ in the length, length of head $4^2/_5$—$4^4/_5$. Head nearly as broad as long. Diameter of eye $4^1/_2$—5 in the length of head. Snout broad, obtuse, $^1/_3$ the length of head, scarcely projecting beyond the mouth; nasal barbel a little nearer to eye than to tip of snout, when laid back extending to the operculum; maxillary barbel extending to the middle of pectoral; upper surface of head, behind the orbits, naked, rugose; this bony area with straight transverse anterior edge; occipital process as long as broad, meeting the basal shield of the dorsal spine; supraclavicular plate small, not produced backwards. Teeth on the palate in a curved uninterrupted band, without posterior median process. Dorsal I. 6; spine weakly serrated behind, $^2/_3$ or $^3/_4$ the length of head. Adipose fin longer than the base of dorsal but shorter than its distance

from the lattter. Anal 14—15. Pectoral spine as long as the head, with strongly serrated inner edge. Ventrals not extending to the anal. Caudal deeply forked. Caudal peduncle twice as long as deep. Greyish; dorsal with dark basal and intramarginal bands. Two specimens 75 and 90 mm. in total length. [After C. Tate Regan, not seen by us].

Habitat: Sumatra (Deli).

12. Leiocassis inornatus Boul.

Liocassis inornatus Boulenger, Ann. Mag. Nat. Hist. (6) XIII. 1894, p. 245.
Liocassis inornatus C. Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 549.

Depth of body 7 times in total length, of head 4 times. Head $1^1/_2$ as long as broad. Snout broad, rounded, scarcely projecting beyond the mouth; occipital region naked, rugose; occipital process nearly twice as long as broad, reaching the basal shield of the dorsal spine; diameter of eye 9 times in length of head; interorbital width 3 times; barbels slender, the maxillary reaching the opercle. Vomerine teeth in a curved uninterrupted band, without posterior median process. Dorsal I. 7; spine feebly serrated behind, $^3/_5$ length of head. Adipose fin $1^2/_3$ times as long as dorsal, a little shorter than its distance from the latter. Anal 16. Pectoral spine $^2/_3$ length of head, strongly serrated on the inner edge. Uniform dark brown. Length of single known specimen 145 mm. [After Boulenger, not seen by us].

Habitat: Borneo (Senah, Sarawak).

13. Leiocassis vaillanti Reg.

Leiocassis Moeschii Vaillant, Notes Leyden Mus. XXIV, n°. 1—3, 1902, p. 61 (nec Boulenger).
Liocassis vaillanti C. Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 549.

D. I (II) 7; A. 15; P. I. 8; V. 6.

Dorsal profile slightly curved between snout and dorsal. Height about 6, head 4, naked and finely granulated above. A separate shield between basal bone of dorsal spine and occipital process, which is longer than broad. The anterior edge of the bony area on the head is emarginate. Eye about 8, situated in the anterior half of the head, about thrice in the rounded snout, which is scarcely more than the interorbital space. The nasal barbels reach farther than the eye, the

maxillary barbels reach hindborder of praeoperculum, the mandibulary barbels almost the gillopening, the mental ones are shorter. Dorsal spine about as long as head without snout, rough behind. Base of adipose fin twice as long as that of the dorsal and equal to the distance between the two fins. Pectoral spine strongly denticulated behind, not much longer than the dorsal one. Ventrals do not reach anal. Caudal deeply incised, the upper lobe the longer. Height of caudal peduncle $2^1/_2$ times in its length. Teeth villiform, in bands on jaws and in a broad band on palate. Brownish, dorsal and anal with dark bars. Length of single specimen known 140 mm. [Type in Leyden Museum examined by us].

Habitat: Borneo (mouth of river Raun!).

14. Leiocassis rugosus Reg.

Liocassis moeschii Boulenger, Ann. Mag. Nat. Hist. (6) XIII. 1894, p. 247 (nec Boulenger 1890).
Liocassis rugosus C. Tate Regan, Ann. Mag. Mat. Hist. (8) XI. 1913, p. 552.

Depth of body $4^1/_2$ in the length, length of head 4. Head $1^1/_3$ as long as broad. Diameter of eye 8 in the length of head, interorbital width $3^3/_5$. Snout broad, rounded, $^1/_3$ the length of head, scarcely projecting beyond the mouth; nasal barbel equidistant from eye and tip of snout, when laid back extending a little beyond the eye; maxillary barbel nearly reaching the base of pectoral; upper surface of head, behind the orbits, naked, rugose; this bony area with the anterior edge deeply emarginate; occipital process as long as broad, meeting the basal shield of the dorsal spine, supra-clavicular plate small not produced backwards. Teeth on the palate in a curved uninterrupted band, without posterior median process. Dorsal I. 7; spine feebly serrated behind, $^2/_3$ the length of head. Adipose fin $1^3/_4$ as long as the base of dorsal and longer than its distance from the latter. Anal 15. Pectoral spine $^4/_5$ the length of head, with strongly serrated inner edge. Ventrals extending to the anal. Caudal forked. Caudal peduncle $1^3/_4$ as long as deep. Yellowish, with very broad brown cross-bands, the first ending posteriorly at the origin of the ventrals, the second above the anal fin, the third on the caudal peduncle; fins greyish. Single specimen 120 mm. in total length. [After Regan; not seen by us].

Habitat: Borneo (Poeh, Sarawak).

15. Leiocassis leiacanthus M. Web. & de Bfrt.

Leiocassis leiacanthus Max Weber & de Beaufort, In: Alfred Maasz „Durch Zentral-Sumatra" II. Fische 1912, p. 15.

D. I. 7; A. 15; P. I. 7; V. 6.

Dorsal profile slightly curved between snout and dorsal. Height $4^1/_3$—$4^1/_2$, head $3^3/_4$, longer than broad and broader than high, naked above, its bones rugose. Occipital process longer than broad, separated by a separate shield (the length of which is equal to its breadth) from the slightly broader basal bone of the dorsal spine, both are rugose. Supraclavicular plate produced backward into a small, pointed process not extending so far back as the humeral (clavicular) process. Eye about 7, situated in the anterior half of the head, more than twice in the rounded slightly prominent snout, which is equal to interorbital space and is $^1/_3$ of the length of the head. Nasal barbels reaching behind the eye. Maxillary barbels reach on opercle, mandibulary ones of about equal length, mental ones much shorter. Dorsal spine half as long as head, not serrated behind. Adipose fin twice as long as dorsal, as long as its distance from that fin. Pectoral spine strongly serrated behind, equal to head without snout. Ventrals reaching anal, their origin nearly midway between dorsal and adipose fin. Origin of anal behind that of adipose fin. Caudal emarginated. Height of caudal peduncle $1^2/_3$ in its length. Small teeth in the jaws and on the palate in rather broad, slightly curved bands. Dark brown, underside of head and belly lighter with three light cross bands, the first from occiput to opercle, the second from end of dorsal to anus, the third at the beginning of the caudal peduncle. A light spot at origin of adipose fin. Caudal, pectorals and ventrals with a black crossband, dorsal with broad, anal with small longitudinal band. Length 62 mm.

Habitat: Sumatra (Kwantan river!).

16. Leiocassis moeschi Boul.

Liocassis moeschii Boulenger, Proc. Zool. Soc. London, 1890, p. 39.
Liocassis moeschii C. Tate Regan, Ann. Mag. Nat. Hist. (8) XI. 1913, p. 549.

D. I. 7; A. 15; P. I. 8.

Upper surface of head naked and rugose; occipital process as long as broad; a separate shield, a little broader than long,

between the occipital process and the basal shield of the dorsal spine; head longer than broad, a little broader than deep; snout not prominent. The depth of the body contained five times in the total length (without caudal), the length of the head thrice and two thirds. Barbels slender and short, the maxillary reaching the opercle. Dorsal spine serrated behind, its length two thirds that of the head. Adipose fin twice as long as dorsal, as long as its distance from the latter. Pectoral spine strong, considerably longer than the dorsal, strongly serrated on the inner edge. Brown above, fins blackish brown. Length 90 mm. [After Boulenger, not seen by us].

Habitat: Sumatra (Deli).

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7. Fam. Akysidae.

More or less elongate, belly flat, skin covered with roundish granules or tubercles, which may be arranged in longitudinal rows. Head depressed, with or without prominent longitudinal ridges, covered by soft skin. A median longitudinal fontanel present. Anterior nostrils tubular, at some distance from the posterior ones, which have a circular rim, the frontborder of which carries a nasal barbel. A pair of maxillary, mandibulary and mental barbels. Snout slightly prominent before the transverse or curved mouthopening. Short dorsal with five soft rays and one or two pungent spines, covered by skin, placed anteriorly, between pectorals and ventrals. Adipose fin absent or present, in latter case opposite to short anal. Ventrals 6-rayed, horizontal, as also the pectorals, which have a strong osseous spine. Caudal truncate or deeply emarginate. Villiform teeth in the jaws, none on the palate. Gillmembranes united with each other and with the isthmus. Gillopening narrow, extending dorsally to the base of the pectoral or above it. Branchiostegals 6.

Key to the genera.

I. Adipose fin present.

a. Gillopening extending dorsally only to the base of the pectoral. Caudal truncate or slightly emarginate . . . . . *Acrochordonichthys* p. 366.

b. Gillopening extending dorsally above the base of the pectoral. Caudal deeply emarginate. . . . *Akysis* p. 370.

II. No adipose fin. Gillopening extending only to the base of the pectoral . . . . . *Breitensteinia* p. 373.

1. Acrochordonichthys Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858. p. 221).

Elongate; head depressed, covered with soft, granular skin. Belly flat. Body with longitudinal rows of tubercles. Eyes small, looking upward, covered by the skin. Anterior nostrils tubular, at some distance behind them the posterior nostrils, which have a circular rim, the frontborder of which carries a nasal barbel. A pair of maxillary barbels, originating with a broad base, on the upper lip. The slender mandibulary barbels far behind angle of mouth, the mental ones behind lower lip. Gape of mouth rather wide and slightly curved. Snout prominent, rounded. A median longitudinal fontanel on the top of the head, visible when the skin is removed. Short dorsal fin midway between pectorals and ventrals, with 5 soft rays and a pungent spine, which is covered by thick skin, and the hindborder of which is slightly denticulated in its middle. Adipose fin low, opposite to short anal. Ventrals with 6 rays, horizontal, as also the pectorals, which have a strong pungent spine, covered by thick skin and strongly denticulated behind. Caudal truncate or slightly emarginate. Villiform teeth in the jaws, none on the palate. Gillopening extending dorsally only to the base of the pectoral. Gillmembranes united with each other and with the isthmus, there may be a small ridge-like free fold across the isthmus. Branchiostegals 6.

Key to the species.

1. Occipital process elongate, oval. . . . . *A. ischnosoma* p. 367.
2. Occipital process triangular.
   a. occipital process more than twice as long as broad at its base, rather narrow and pointed. . . . . *A. rugosus* p. 368.
   b. occipital process $1^1/_2$ times longer than broad at its base, bluntly pointed. . . . . *A. pleurostigma* p. 368.
3. Occipital process quadratic . . . . . *A. melanogaster* p. 369.

1. Acrochordonichthys ischnosoma Blkr.

Acrochordonichthys ischnosoma Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 232. — Atl. Ichth. II. 1862, p. 70.
Acrochordonichthys ischnosoma Günther, Cat. Brit. Mus. V. 1864, p. 96.

B. 6; D. I. 5; A. 10; P. I. 7; V. 6.

Height $8^1/_3$, greatest width $5^2/_3$, head 5 in the total length. Dorsal profile slightly convex. Nasal barbels scarcely surpassing eye, maxillary barbels reaching operculum, mandibulary barbels reaching base of pectoral spine, mental ones short. Occipital process elongate, oval, more than twice longer than

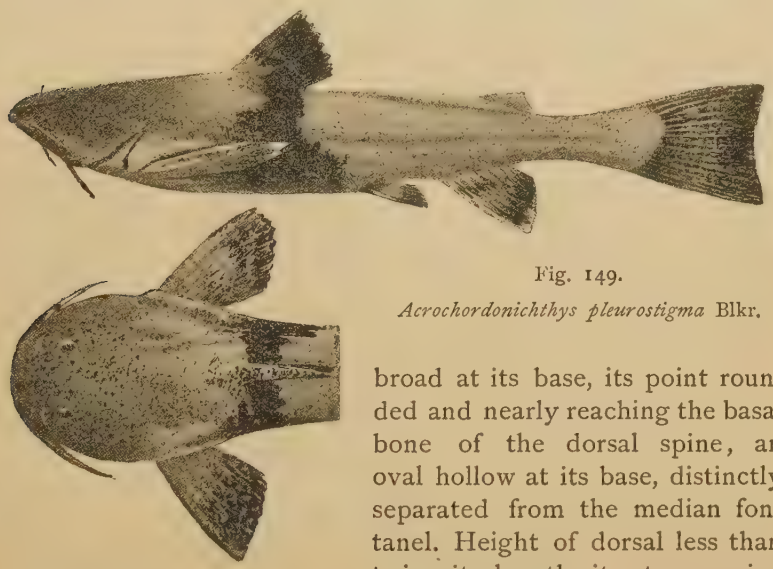

Fig. 149.
Acrochordonichthys pleurostigma Blkr.

broad at its base, its point rounded and nearly reaching the basal bone of the dorsal spine, an oval hollow at its base, distinctly separated from the median fontanel. Height of dorsal less than twice its length, its strong spine 2 times shorter than head, about as long as first ray. Anal scarcely higher than long. Ventrals obtusely angulate, about 2 times shorter than pectorals. Pectorals slightly shorter than head, their strong curved spine much longer than the dorsal spine. Caudal slightly emarginate, about $6^1/_4$ in total length. Greyish brown above, lighter below. Length of single specimen known 115 mm. [After Bleeker, not seen by us].

Nomen indig.: Kèkel (Sundan.).

Habitat: Java (Parongkalong, river Tjitarum).

2. Acrochordonichthys rugosus (Blkr.).

Pimelodus rugosus Bleeker, Verh. Bat. Gen. XXI. I. 1847, Nieuwe bijdr. Siluri, p. 11.
Acrochordonichthys platycephalus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 224. — Atl. Ichth. II. 1862, p. 67.
Acrochordonichthys rugosus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 227. — Atl. Ichth. II. 1862, p. 68.
Acrochordonichthys platycephalus Günther, Cat. Brit. Mus. V. 1864, p. 94.
Acrochordonichthys rugosus Günther, Cat. Brit. Mus. V. 1864, p. 95.

B. 6; D. I. 5; A. 9—10; P. I. 7; V. 6.

Height $6^1/_4$—7 in total length, greatest width $4^1/_6$—$4^3/_4$. Head $4^3/_4$ to sligthly more than 5. Dorsal profile from dorsal to the blunt rounded snout sloping down in a nearly straight line. Nasal barbels slightly longer than eye, maxillary barbels reaching to gillopening or not so far, mandibulary barbels to base of pectorals and mental barbels much shorter. Occipital process rather narrow, triangular, somewhat more than twice as long as broad at its base; an oval hollow at its base, distinctly separated from the median fontanel. Laterally on each side from this hollow a deep groove. Origin of dorsal above the middle of the pectorals, its height equal to postorbital part of head, its spine somewhat shorter. Anal nearly of equal height, opposite to posterior part of low adipose fin. Ventrals rounded, not reaching anal, about equal to postorbital part of head. Pectorals slightly shorter than head, their spine equal to head from anterior nostril, much longer than the dorsal one. Caudal slightly emarginate, as long as head from posterior nostril. Least height of caudal peduncle more than thrice in its length. Entirely brownish or blackish, with irregular light spots. Dorsal, anal, ventrals and pectorals with a whitish margin. In *A. platycephalus* 3 round distant yellow spots, posteriorly on the sides. Length 110 mm. [Specimens of *A. rugosus* of Bleeker's collection in Leyden Museum examined].

Nomen indig.: Djogo-ripo (Javan.).

Habitat: Java (Buitenzorg!, Surakarta); Sumatra (Palembang).

In rivers.

3. Acrochordonichthys pleurostigma (Blkr.) [Fig. 149, p. 367].

Pimelodus pleurostigma Bleeker, Nat. Tijdschr. Ned. Indië, VII. 1854, p. 442.
Pimelodus zonatus Bleeker, Nat. Tijdschr. Ned. Indië, VII. 1854, p. 444.

Acrochordonichthys pleurostigma Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 229. — Atl. Ichth. II. 1862, p. 68.
Acrochordonichthys zonatus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 230. — Atl. Ichth. II. 1862, p. 69.
Acrochordonichthys pleurostigma Günther, Cat. Brit. Mus. V. 1864, p. 95.
Acrochordonichthys zonatus Günther, Cat. Brit. Mus. V. 1864, p. 95.

B. 6; D. I. 5; A. 8—10; P. I. 6—7; V. 6.

Height $6^1/_3$—$7^1/_2$, greatest width $4^3/_5$—5, head about 5 in the total length. Dorsal profile nearly straight. Nasal barbels slightly longer than eye, maxillary barbels extending to front-border of operculum, mandibulary barbels not reaching gill-opening, mental barbels short. Occipital process triangular, bluntly pointed, about $1^1/_2$ times longer than broad at its base. Before its base a longitudinal groove, with a deep groove at both sides, distinctly separated from the median fontanel. Origine of dorsal above the middle of the pectorals, its height about equal to postorbital part of head, its spine somewhat longer. Anal of about the same height, ventrals reaching anal, somewhat shorter than postorbital part of head. Pectorals as long as head from anterior nostril, their spine of about the same length, much longer than the dorsal spine. Caudal slightly emarginate, about $^2/_3$ of head. Least depth of caudal peduncle more than thrice its length. Yellowish or brownish, with a narrower or broader blackish band round the body below the dorsal, which may extend to the hinderhalf of the tail (*A. zonatus*). In some specimens (*A. pleurostigma*) a series of several rounded yellow spots along the sides. Length 100 mm. [Specimens of *A. zonatus* and *A. pleurostigma* of Bleeker's collection in the Leyden Museum examined by us].

Nomen indig.: Kèkel, Kechkel (Mal. Batav. and Sundan.).

Habitat: Java (Batavia, Buitenzorg!, Menes, Parongkalong).

4. Acrochordonichthys melanogaster (Blkr.).

Pimelodus melanogaster Bleeker, Nat. Tijdschr. Ned. Indië, VII. 1854, p. 89.
Acrochordonichthys melanogaster Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 224. — Atl. Ichth. II. 1862, p. 67.
Acrochordonichthys melanogaster Günther, Cat. Brit. Mus. V. 1864, p. 94.

B. 6; D. I. 5; A. 9; P. I. 7; V. 6.

Height $6^2/_3$, greatest width 4, head $4^3/_4$ in total length. Dorsal profile convex, only on the vertex slightly concave. Nasal barbels not or slightly extending beyond eye, maxillary

barbels scarcely reaching opercles. Occipital process slightly longer than broad at its base, its top truncate or emarginate, its sides parallel. Median fontanel reaching to base of occipital process. Height of dorsal less than twice its length, about equal to height of body, its spine of about the same height and $1^2/_3$—$1^3/_5$ in length of head. Height of anal less than height of body, slightly more than its length, more than twice shorter than adipose fin. Ventrals obtuse, about twice shorter than pectorals. Pectorals acute, slightly shorter than head, their strong spine curved, longer than the dorsal one, in the middle of its length provided with some teeth. Caudal truncate with acute angles, $6^2/_3$ in length. Yellowish brown above, dark brown below, fins yellowish brown, densely reticulated. Length of single specimen known 110 mm. [After Bleeker, not seen by us].

Habitat: Sumatra (Palembang).

Doubtful species.

Acrochordonichthys pachyderma Vaillant, Notes Leyden Mus. XXIV. n°. 1—3, 1902, p. 66. Borneo (river Bluu).

Sosia chamaleon Vaillant, Notes Leyden Mus. XXIV. n°. 1—3, 1902, p. 82, Borneo (river Kapuas, river Mandai, river Sibau).

Acrochordonichthys obscurus Popta, Notes Leyden Mus. XXIV. n°. 4, 1904, p. 187. — Notes Leyden Mus. XXVII. 1906, p. 55. Nomen indig.: Putero, Borneo (river Bongan).

Acrochordonichthys büttikoferi Popta, Notes Leyden Mus. XXIV. n°. 4, 1904, p. 188. — Notes Leyden Mus. XXVII. 1906, p. 58, Borneo (rivers Bongan and Bo).

Acrochordonichthys varius Popta, Notes Leyden Mus. XXIV. n°. 4, 1904, p. 189. — Notes Leyden Mus. XXVII. 1906, p. 63, Borneo (river Bo).

We believe that the above named species, examined by us in the Leyden Museum, belong to *A. melanogaster* or are only local or colour-varieties, though their median fontanel is far distant from the base of the occipital process, at the base of which lies a separate small hollow. It may be that Bleeker has overlooked the fact that these fontanels are separated.

2. Akysis Bleeker.

(Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1858, p. 234).

Head broad, depressed, covered by soft skin, body tapering behind. Skin covered with roundish granules. Belly flattish. Eyes small, looking upward, covered by skin. Anterior nostril

tubular, posterior nostril at some distance behind it, partly surrounded by a rim, from which rises anteriorly, with a broad base, a rather long nasal barbel. The long maxillary barbels originating with a broad base at the angle of the mouth. The mandibulary barbels close behind it and the mental ones below it. All the barbels are long and slender. Gape of mouth moderate, transverse, with the upperlip the longer. A median rhombic longitudinal fontanel on the top of the head, extending to the base of the occipital process, divided by a transverse osseous ridge. Short dorsal, the hinder end of which is situated above the origin of the ventrals (always?), with 5 soft rays and a pungent spine, covered by thick skin. Adipose fin opposite to anal. Ventrals with 6 rays, horizontal, extending to anal. The horizontal pectorals with a strong osseous spine, longitudinally furrowed, serrated or not, covered by thick skin and prolonged by a cartilaginous filament. Caudal deeply emarginate. Villiform teeth in the jaws, none on the palate. Gillopening extending dorsally above the base of the pectoral. Gillmembranes broadly united with the isthmus and each other. The distance between the mouthopening and their hindborder very short, the skin here radially folded. Branchiostegals 6.

Key to the species.

1. Pectoral spine with strong teeth at its hindborder . . . *A. armatus* p. 371.
2. Pectoral spine without strong teeth . . . . . *A. variegatus* p. 372.

1. Akysis armatus Vaill.

Akysis armatus Vaillant, Notes Leyden Mus. XXIV. n°. 1—3, 1902, p. 64.

D. II. 4; A. 9; P. I. 6; V. 6.

Height 6, head 4. Eye 6, medium, $^1/_3$ of the interorbital space. Snout obtuse, about $^1/_3$ of the length of the head. Nasal barbels extending to branchial opening, maxillary barbels to the second $^1/_3$ of the pectorals, mandibulary barbels to middle of pectoral spine, mental barbels to insertion of mandibulary ones. Posterior border of dorsal spine smooth. Adipose fin of moderate height. Pectoral spine robust, slightly curved, its posterior border with 8 or 9 strong teeth, equal to or more than the breadth of the spine. Dark red, dorsally with numerous yellow spots in longitudinal rows on the head, in

transverse rows on the body, one on the occipital region, a second before dorsal spine, a third below the middle of the dorsal fin, a fourth just behind it. On the caudal peduncle they form vertical bands, situated on the sides. Ventral surface uniform yellowish. Length of single specimen known 26 mm. [Type in Leyden Museum seen by us].

Habitat: Borneo (river Mahakam!).

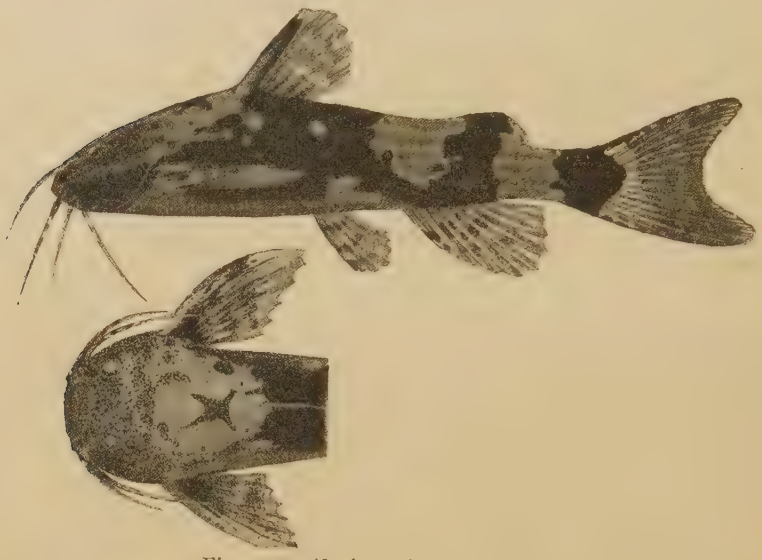

Fig. 150. *Akysis variegatus* (Blkr.).

2. Akysis variegatus (Blkr.).

Pimelodus variegatus Bleeker, Nat. & Geneesk. Arch. Ned. Ind. III (2). 1846, p. 177.
Akysis variegatus Bleeker, Ichth. Arch. Ind. Prodr. I. Siluri, 1859, p. 235. — Atl. Ichth. II. 1862, p. 65.
Akysis variegatus Günther, Cat. Brit. Mus. V. 1864, p. 96.

B. 6; D. I. 5; A. 8—9; P. I. 5—6; V. 6.

Height about 5, head about 4, somewhat broader than long, its height $^3/_5$ of its width. Rhombic median groove visible through the skin as also the carinated occipital process. Eyes in the anterior part of the head, very small. Nasal barbels reaching to base of pectorals, maxillary ones on first $^1/_3$ of pectorals, mandibulary ones somewhat farther, mental ones shorter (according to Bleeker the barbels are shorter). Dorsal spine furrowed, as long as distance from posterior nostril to end of head, with

a minute spine anteriorly at its base, longest dorsal ray slightly longer. Base of adipose fin longer than that of the dorsal, equal to or shorter than its distance from the latter. Anal rounded, its height about equal to that of the dorsal. Ventrals rounded, reaching to anal, their origin below end of dorsal. Osseous part of pectoral spine flat, furrowed, about equal to head. Caudal deeply emarginate. Caudal peduncle about twice as long as high. Yellowish brown, with dark brown irregular cross-bands, one on the head, one below and behind dorsal, one through adipose fin to anal, the fourth on base of caudal. Fins and barbels variegated with brown. Length 43 mm.

Nomen indig.: Kèkel, ikan belang (Mal. Batav.), Bangon (Sundan.).

Habitat: Java (Batavia!, Parongkalong).

In rivers, descending to their mouth.

Doubtful species.

Akysis macronema Blkr.

Akysis macronema Bleeker, Act. Soc. Scient. Indo-Neerl. VIII. 1860, Negende Bijdr. Sumatra p. 11. — Atl. Ichth. II. 1862, p. 65.
Akysis macronema Günther, Cat. Brit. Mus. V. 1864, p. 97.

According to Bleeker this species differs from *A. variegatus* (Blkr.) in that the height is less, the maxillary barbels are somewhat longer, the adipose fin is shorter and its distance from the dorsal twice its length. The dorsal spine wants the minute spine at its base.

Bleeker's specimens in the Leyden Museum are in too bad a state to allow of a decision on the validity of this species.

3. Breitensteinia Steindachner.

(Steindachner, Sitzb. Akademie Wien LXXXIII. 1881, p. 13).

Both trunk and tail elongate. The tail becoming hindwards gradually more four sided, by the prominence of the dorsal, ventral and lateral processes of the vertebrae. Head depressed, spatulate, superiorly with prominent blunt longitudinal ridges. Maxillary a little prominent before the terminal curved mouth-opening. Anterior nostril forming a short tubule near the border of the mouth, posterior nostril close to the eye, with a very short tentacle. Eyes very small, looking upwards, covered

by skin. A strong barbel at the corner of the maxillary, a pair of much smaller ones at the chin, two larger mandibulary ones far behind them. Dorsal short with two contiguous spines. No adipose fin. Anal short, far behind anus, its origin in the middle of the total length. Ventrals behind the dorsal. Pectorals horizontal, with a strong denticulated spine. Caudal truncate. Gillopening not surpassing upwards the base of the pectorals, gillmembranes confluent and united with the isthmus. No teeth on the palate, those in the jaws small, villiform, in a rather broad band. Skin with longitudinal rows of tubercles on trunk and anterior part of tail.

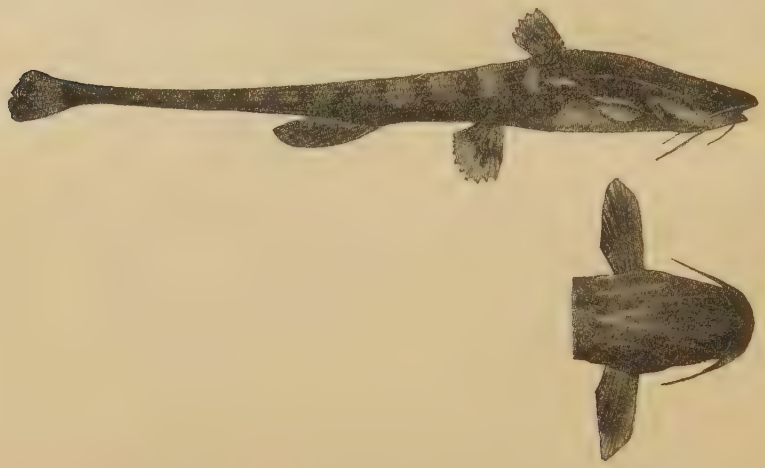

Fig. 151. *Breitensteinia insignis* Steind.

1. Breitensteinia insignis Steind.

Breitensteinia insignis Steindachner, Sitzber. Akad. Wien, LXXXIII. 1881, Ichth. Beitr. X, p. 213. — Ichth. Beitr. XI, Fig. 2.
Breitensteinia insignis Vaillant, Notes Leyden Mus. XXIV. 1902, p. 76.

D. II. 5; A. 2. 8; P. I. 7; V. 6.

Height 10—12, head $5^1/_2$—6. Snout $3^3/_4$ in head. Occipital process forming a prominent ridge, anteriorly devided in two blunt ridges which are again confluent near the nostrils, enclosing a lozenge-shaped concavity. From their posterior quarter two blunt ridges run forward below the eye to the anterior nostrils. Parallel to the occipital process a strong ridge deflecting ventrally along the operculum. Scapular process very prominent, reaching to about the middle of the pectoral spine when

laid along the body; below it an axillary pore. Maxillary barbels shorter than the postorbital part of the head. Mandibulary barbels reaching the thorax, mental barbels about half as long. Height of dorsal about equal to half of head, osseous part of its united spines lower. Height of anal considerably less than that of dorsal, nearly equalling the rounded ventrals. Pectorals a little shorter than head, their spine still shorter, strong and broad, its hindborder with strong spines. Cream-coloured, sides of trunk and tail and fins irregularly clouded and spotted with black. Upperside of head dark. Length 190 mm.

Habitat: Borneo (Teweh, Kapuas); Sumatra (Djambi!).

In rivers.

ADDENDA AND CORRIGENDA.

p. 41. 9. *Engraulis dussumieri* C.V. In the synonymy of this species it has been forgotten to quote: *Engraulis Dussumieri* Bleeker, Atl. Ichth. vi. 1866—1872, p. 133.

p. 42. In the last line: "8 being ventral" must be read: "8 being postventral".

p. 76. 8. *Clupea (Harengula) stereolepis* (Ogilby). In a paper (Records Australian Museum, ix. n°. 3, 1913, p. 355), which we received by the kindness of the author, when the first part of this volume was already printed, Mc Culloch says on p. 356: "I have compared one of the types of *Harengula stereolepis*, Ogilby, with a co-type of *H. kunzei*, Bleeker, and consider that they are the same species. I have failed, however, to find the palatine teeth mentioned by both Bleeker and Day, and they are wanting in Bleeker's co-type. The Torres Strait fish as a whole are more slender than the figures of *S. kunzei*, but they vary considerably, and some are quite as deep as the typical form. The position of the ventrals is also variable, being sometimes before the middle of the dorsal, and sometimes behind that point. The accompanying figure represents a Murray Island specimen".

As we have united *Harengula kunzei* Blkr. with *Clupea (Harengula) moluccensis* Blkr., *Clupea (Harengula) stereolepis* (Ogilby) ought to be brought under the synonymy of *Clupea (Harengula) moluccensis* Blkr., if the interpretation of Mc Culloch is right.

In the second line from bottom for *stereolepsis* read: *stereolepis*.

p. 81. *Clupea (Harengula) moluccensis* (Blkr.), add to the synonymy:

Sardinella lineolata Cuvier & Valenciennes, Hist. nat. Poissons xx. 1847, p. 272.

Clupea (Harengula) dubia Bleeker, Atl. Ichth. vi. livr. 25 & 26, 1872, p. 108.

Dr. Pellegrin kindly gave us full information about the type of *Sardinella lineolata* C.V. from Buru, in the Muséum d'histoire naturelle at Paris, through which we are able to state the above synonymy. The name *lineolata* however is preoccupied by *Clupea lineolata* C.V. (Hist. nat. d. Poiss. xx, p. 256) and can therefore not be used.

Bleeker's species *Clupea (Harengula) dubia* was based on the description of *Sardinella lineolata* by Cuvier & Valenciennes.

According to Mc Culloch (see the preceding note) *Harengula stereolepis* Ogilby is a synonym of *Harengula Kunzei* Blkr., which we have united (see p. 81) with *Clupea (Harengula) moluccensis*.

p. 226. *Paraplotosus albilabris* (C.V.), add to the habitat: Dunk Island, Australia, according to J. Douglas Ogilby (Proc. Roy. Soc. Queensland, xxi. 1907, p. 23).

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1) As in Java the three languages: javanese, sundanese and malay are spoken, we have accordingly placed behind the indigenous names (Malay.), (Sundan.) or (Javan.). In naming a fish the malay people use as a rule "ikan" = fish before the special name. In most cases we have omitted "ikan".

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